ARID TECHNOLOGIES INC.

Gasoline Storage Tank Evaporative Loss Dynamics and Fuel Savings

OTC Phone Conference
14 Feb 2012

ARID Technologies, Inc.,Ted Tiberi;

Wawa, Inc., Josh Worth

www.ARIDtech.com

Topics of Discussion

- Evaporative losses in gasoline storage tanks
- Stage II / ORVR Interactions
  - Flawed Math on “widespread use”
  - Emissions from non ORVR vehicles
  - Review and Response to dKC (Klausmeier Report) Summary provided to State of CT
- Wawa Insights with 140 Permeator Units
  - Operating History
  - Fuel Savings
  - NJ Stack Testing
- Quantitative measurement of Fuel Savings & Emissions Reductions
  - Lantana, Florida , Federal Way, Washington

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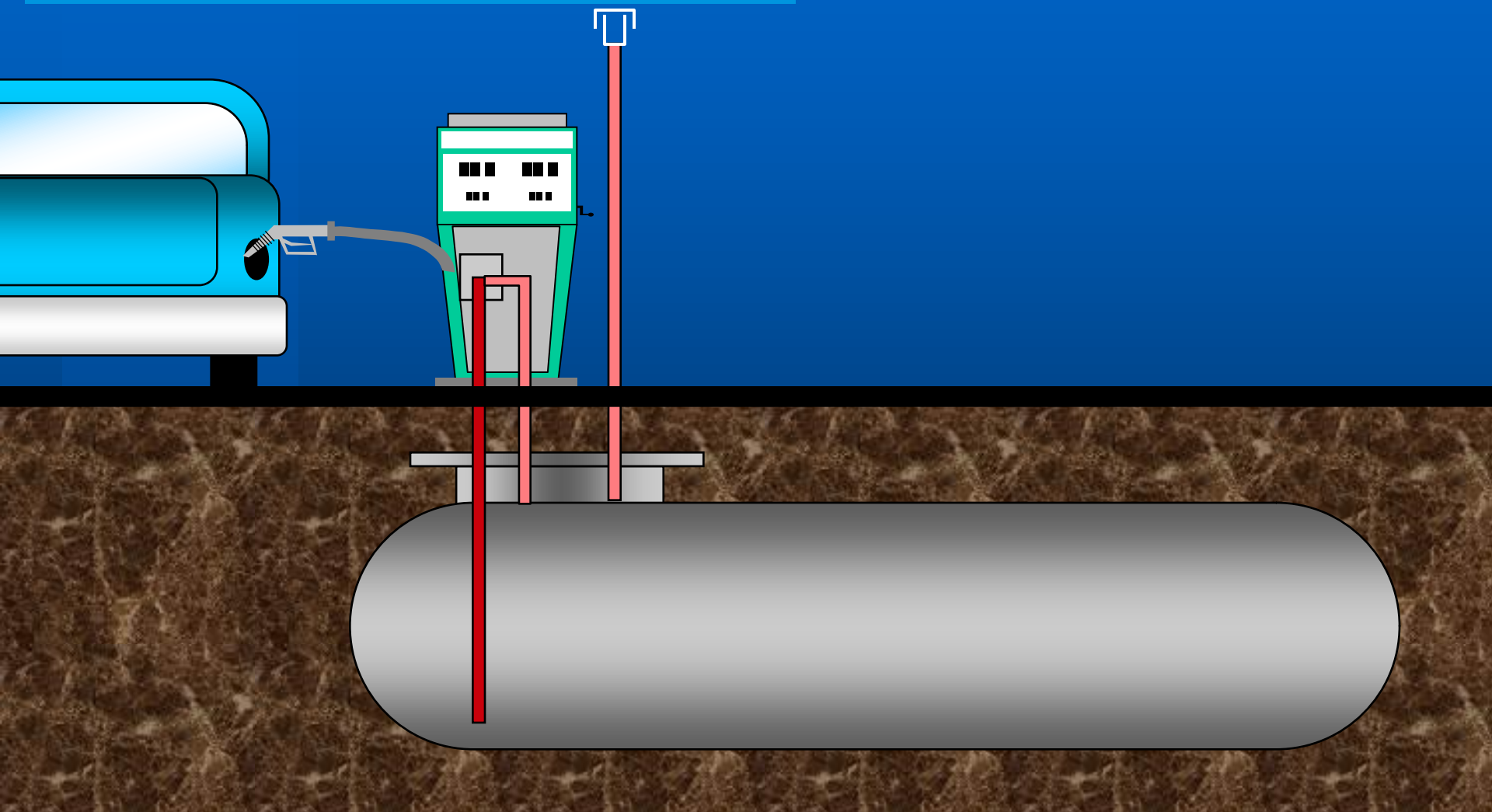
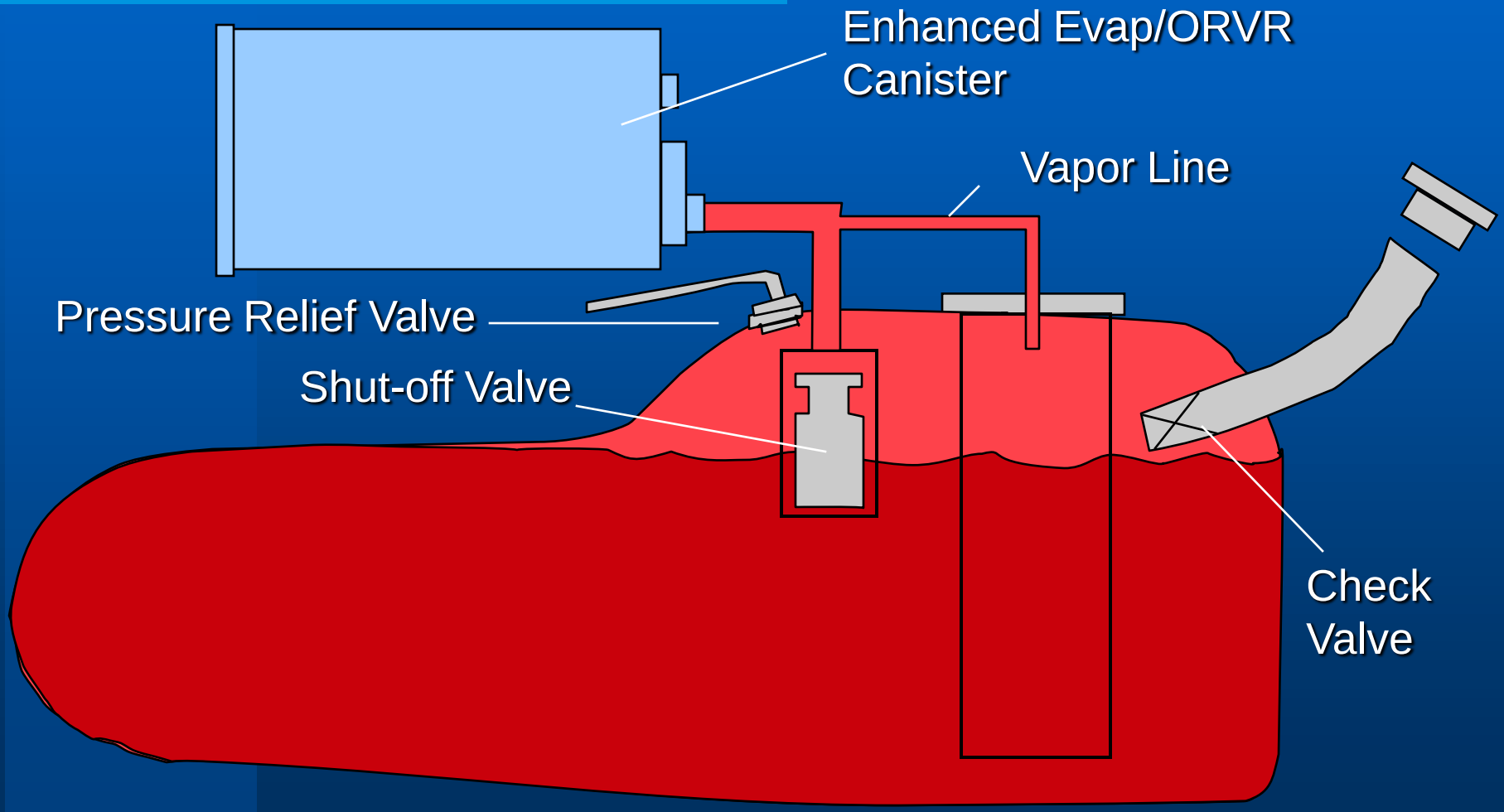
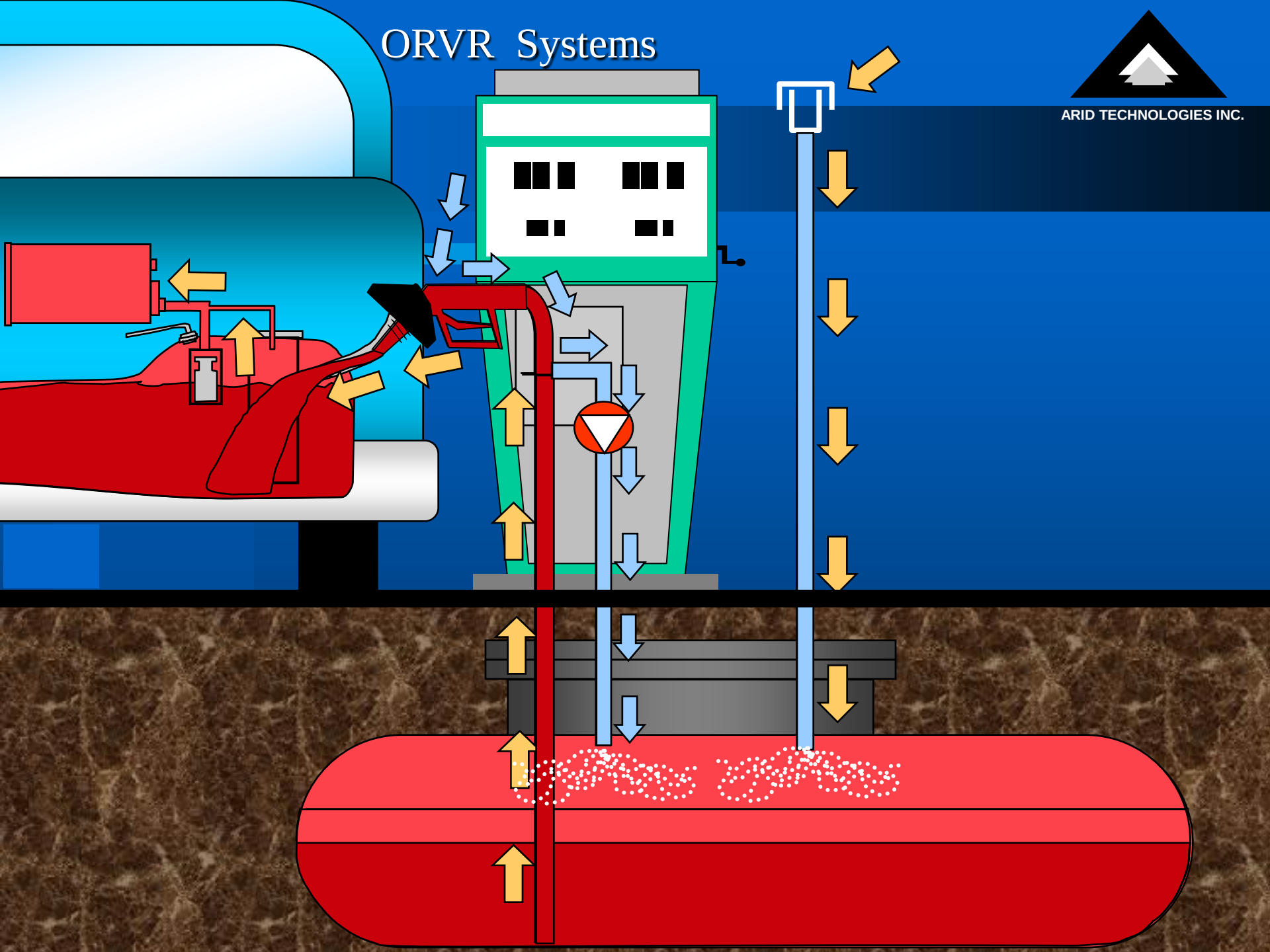
Stage II Recovery Systems



ORVR Configuration




ORVR Systems
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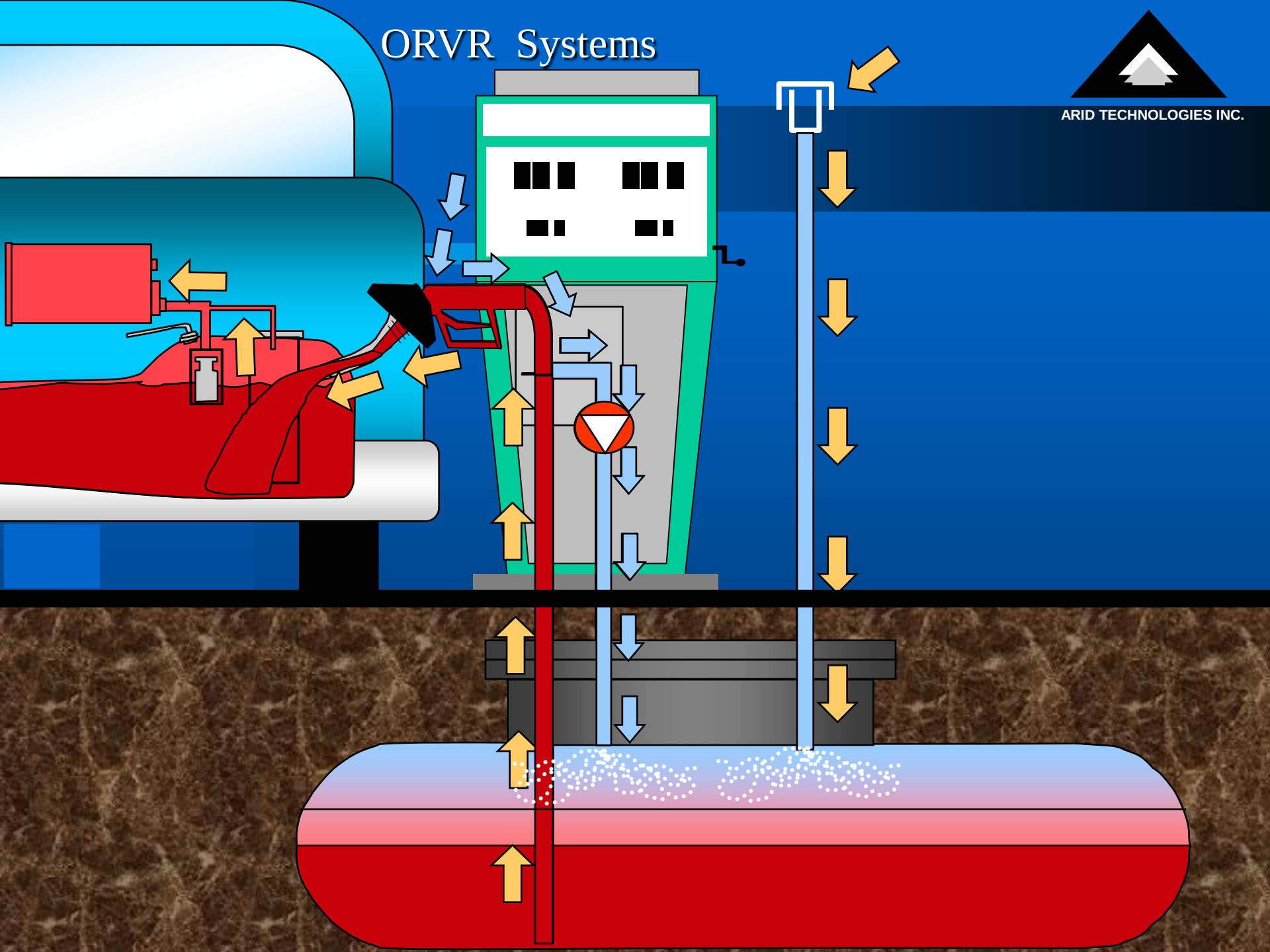
ORVR Systems



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ORVR Systems

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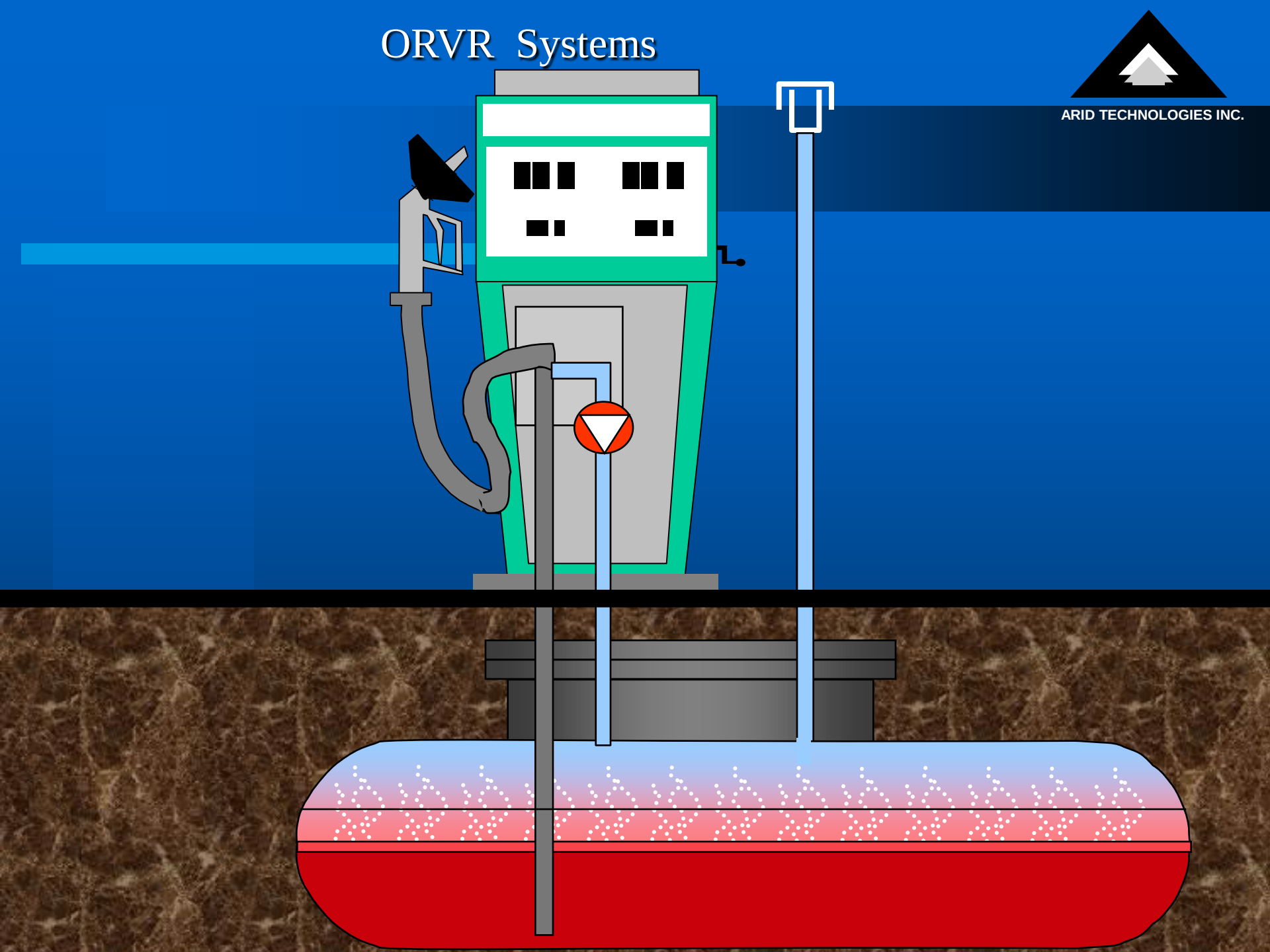
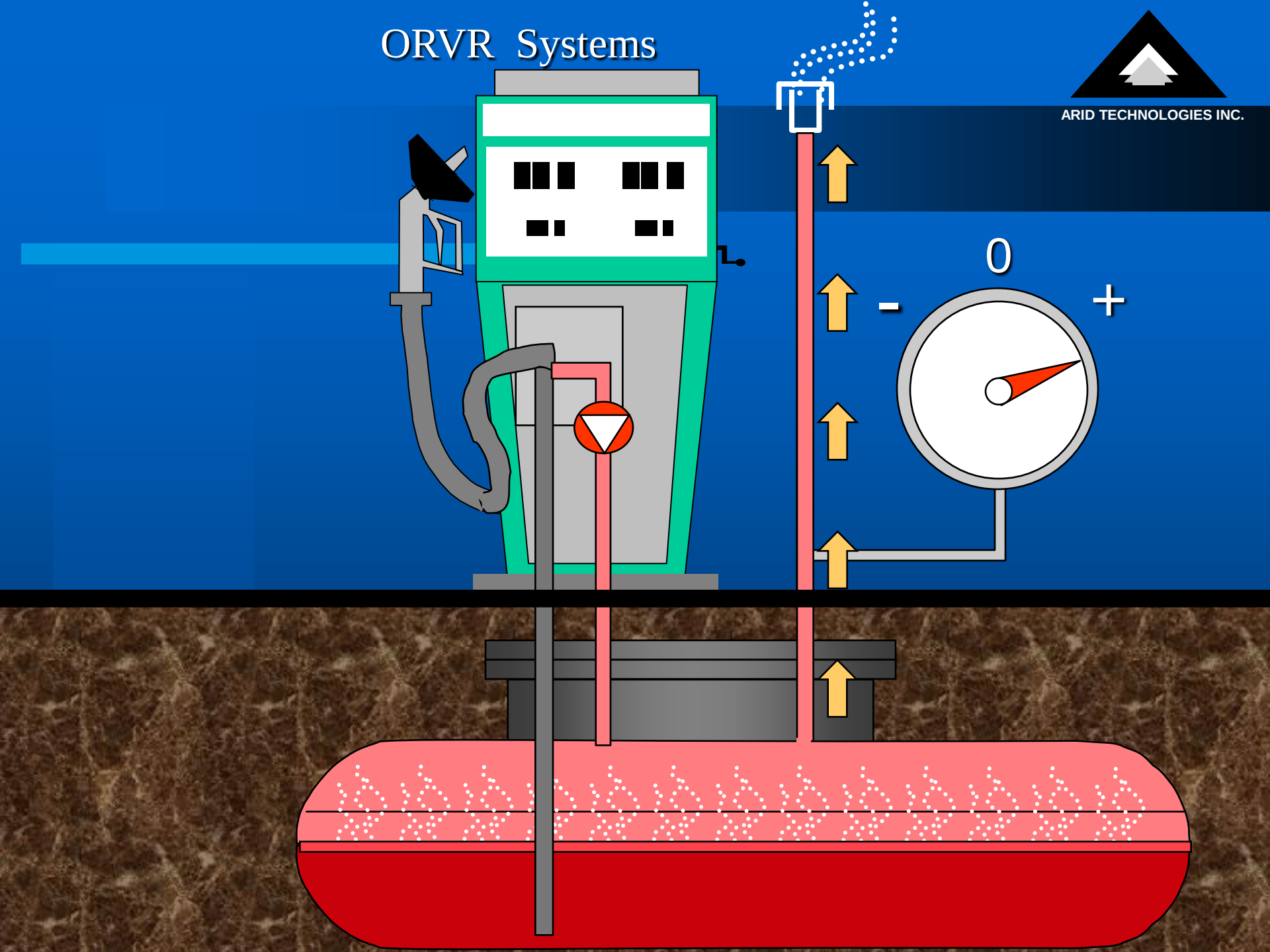


ORVR Systems



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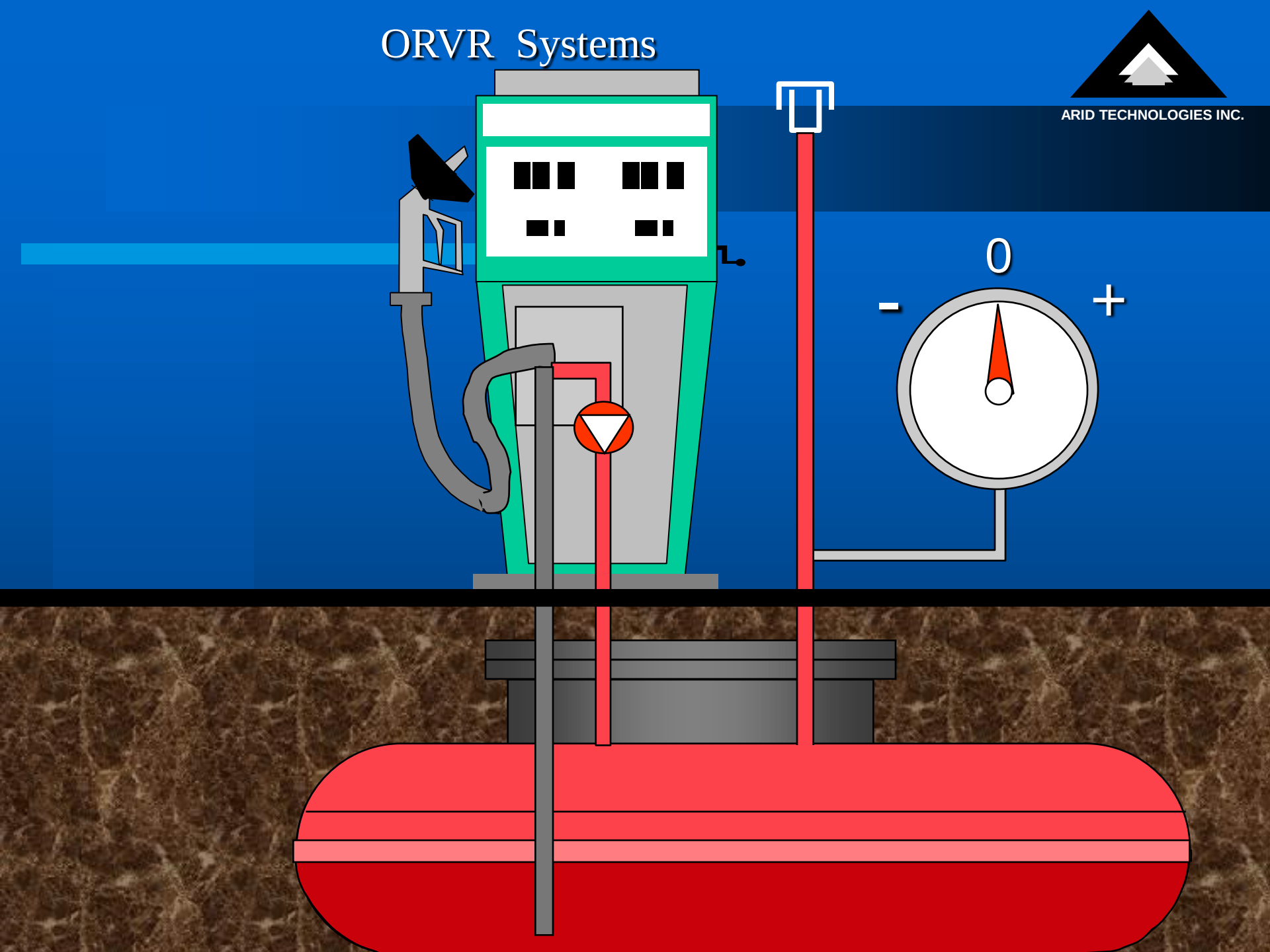

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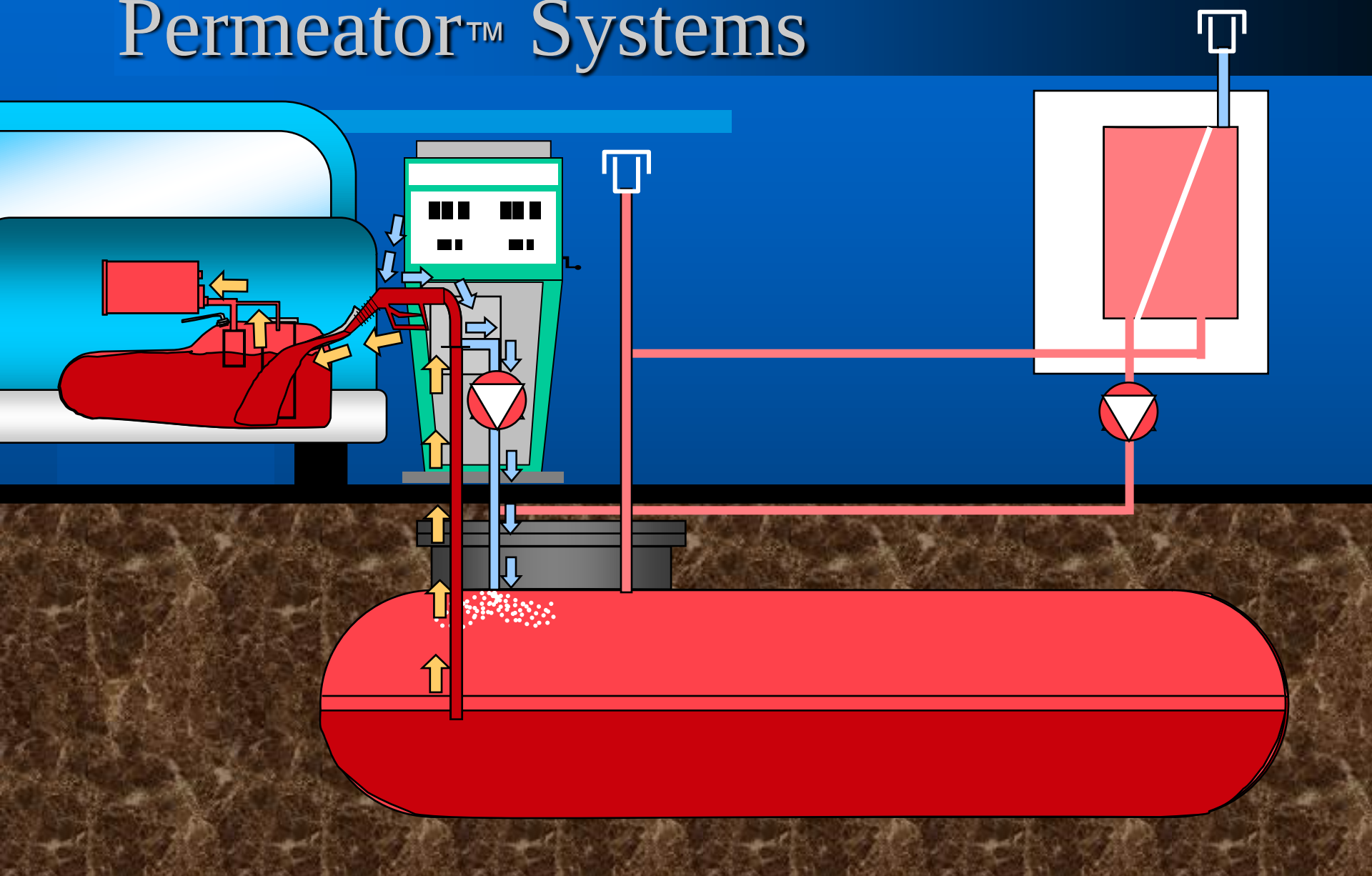
Permeator™ Systems



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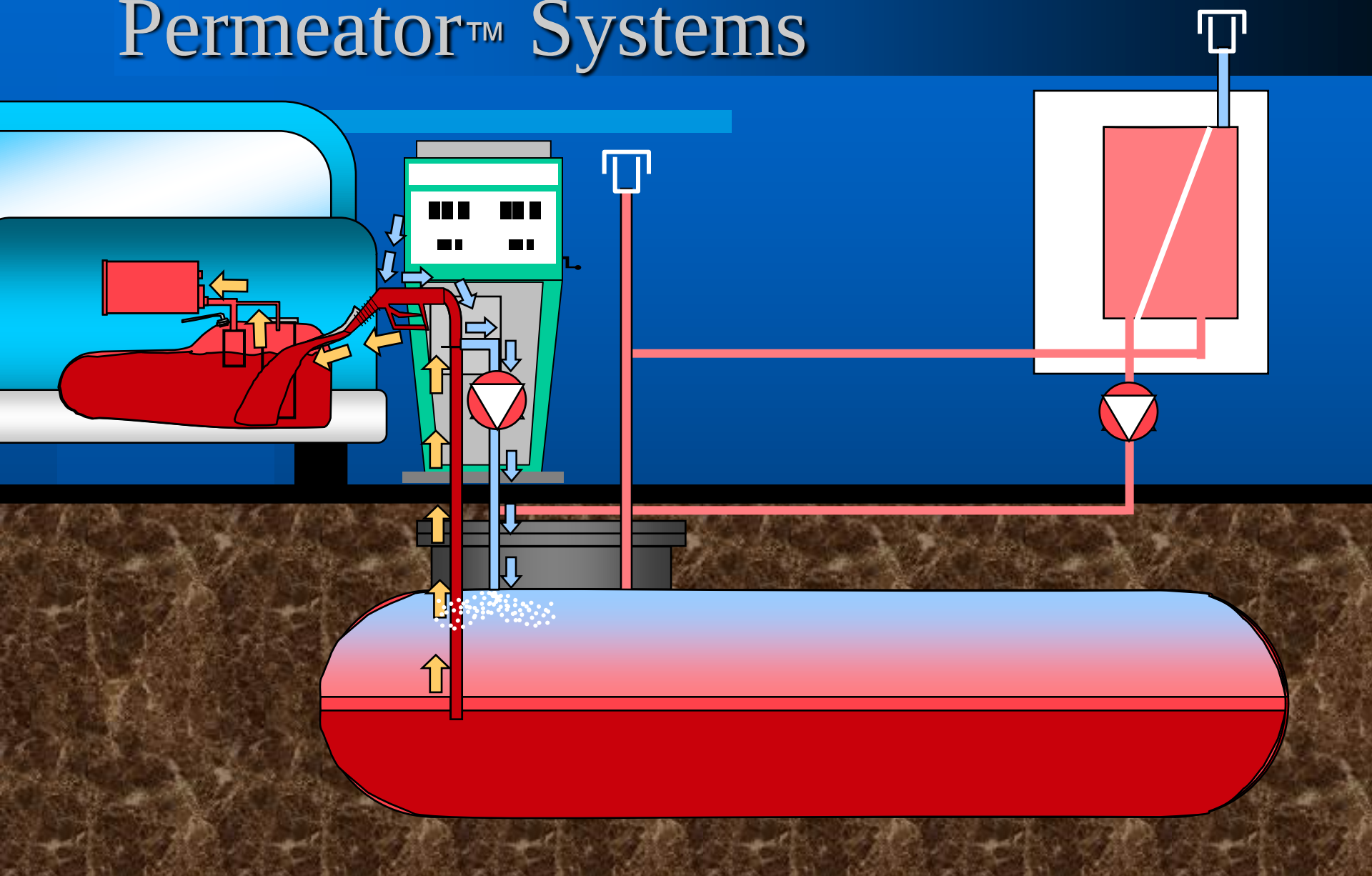
Permeator™ Systems



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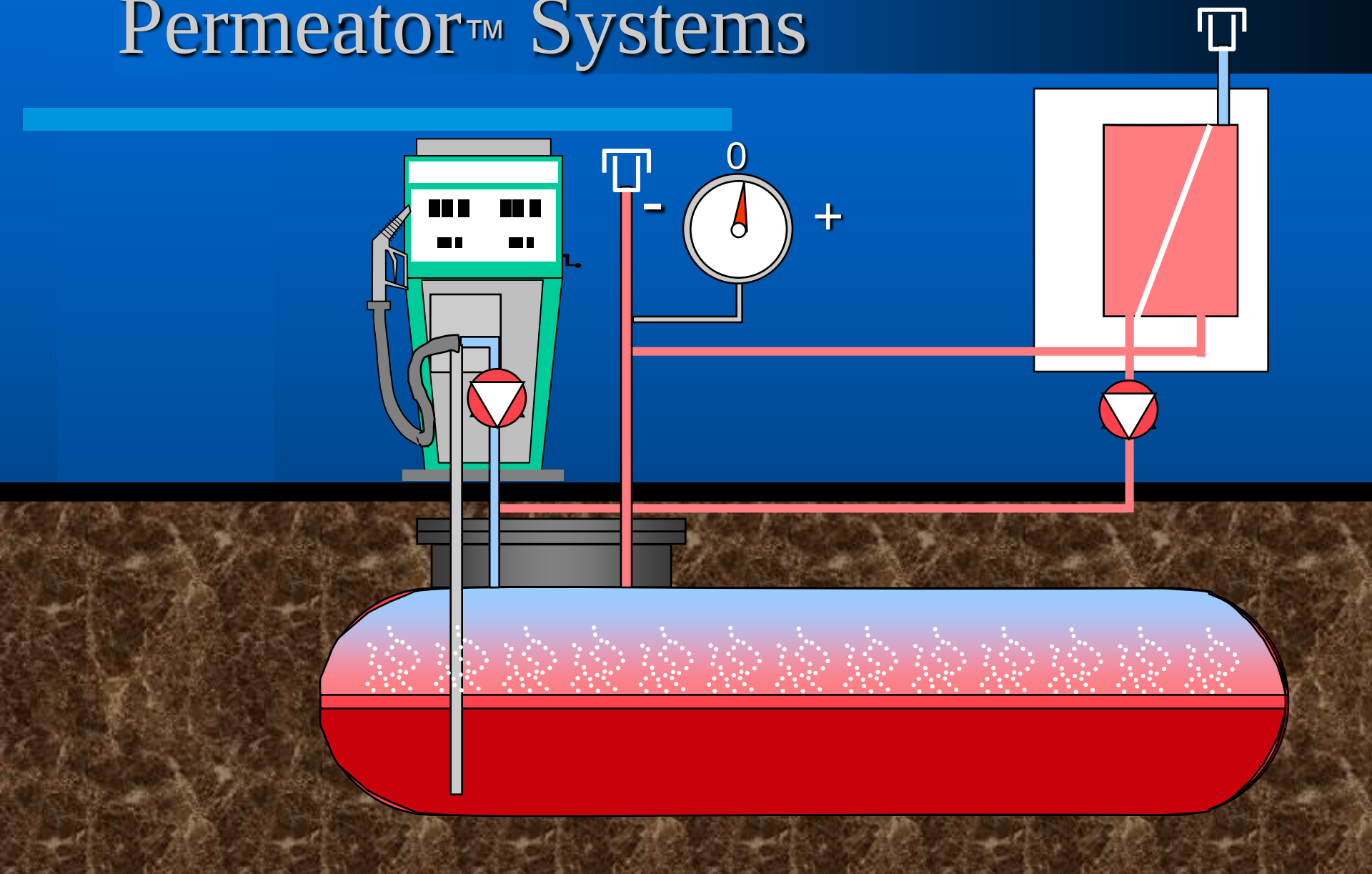
Permeator™ Systems



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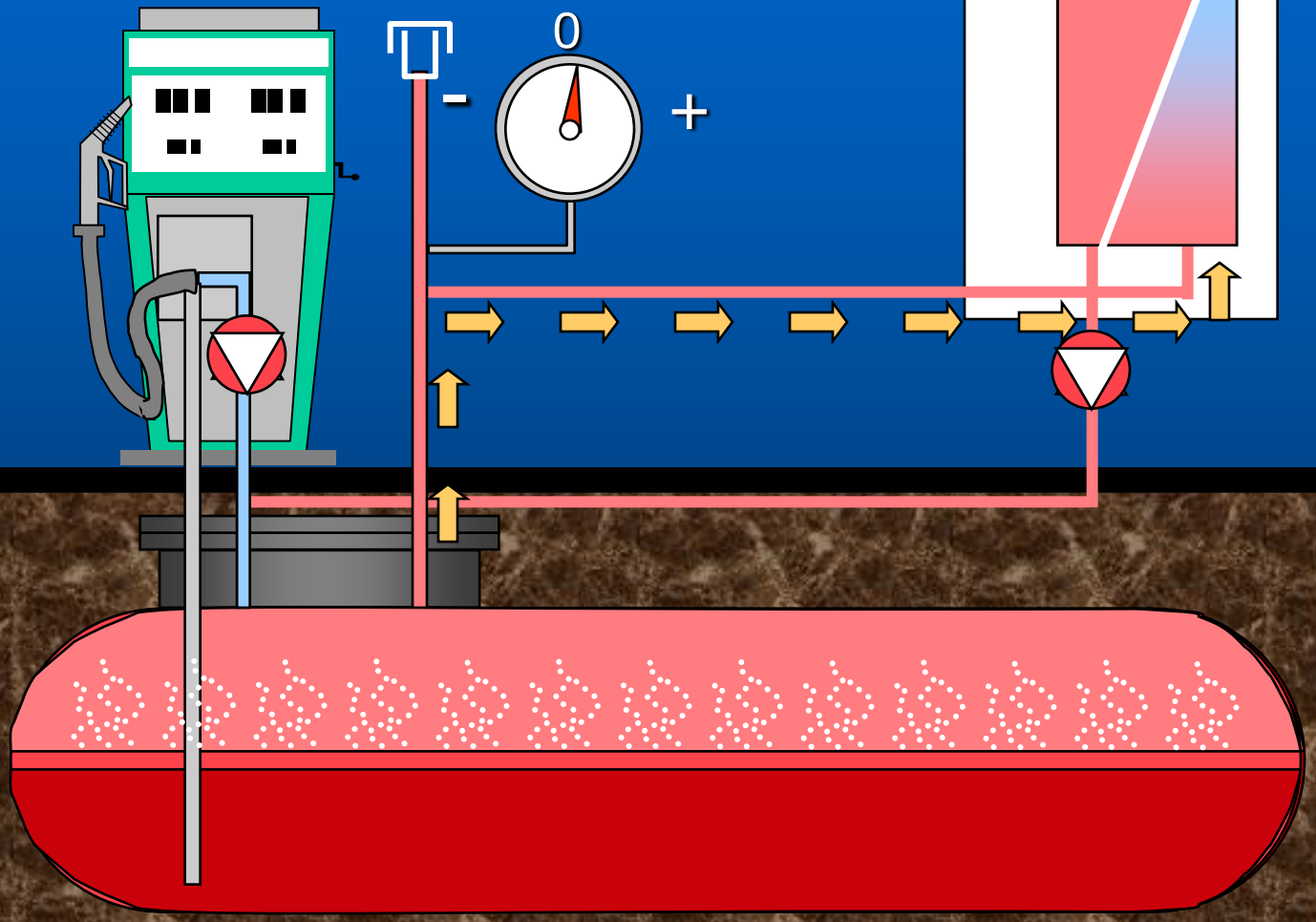
Permeator™ Systems



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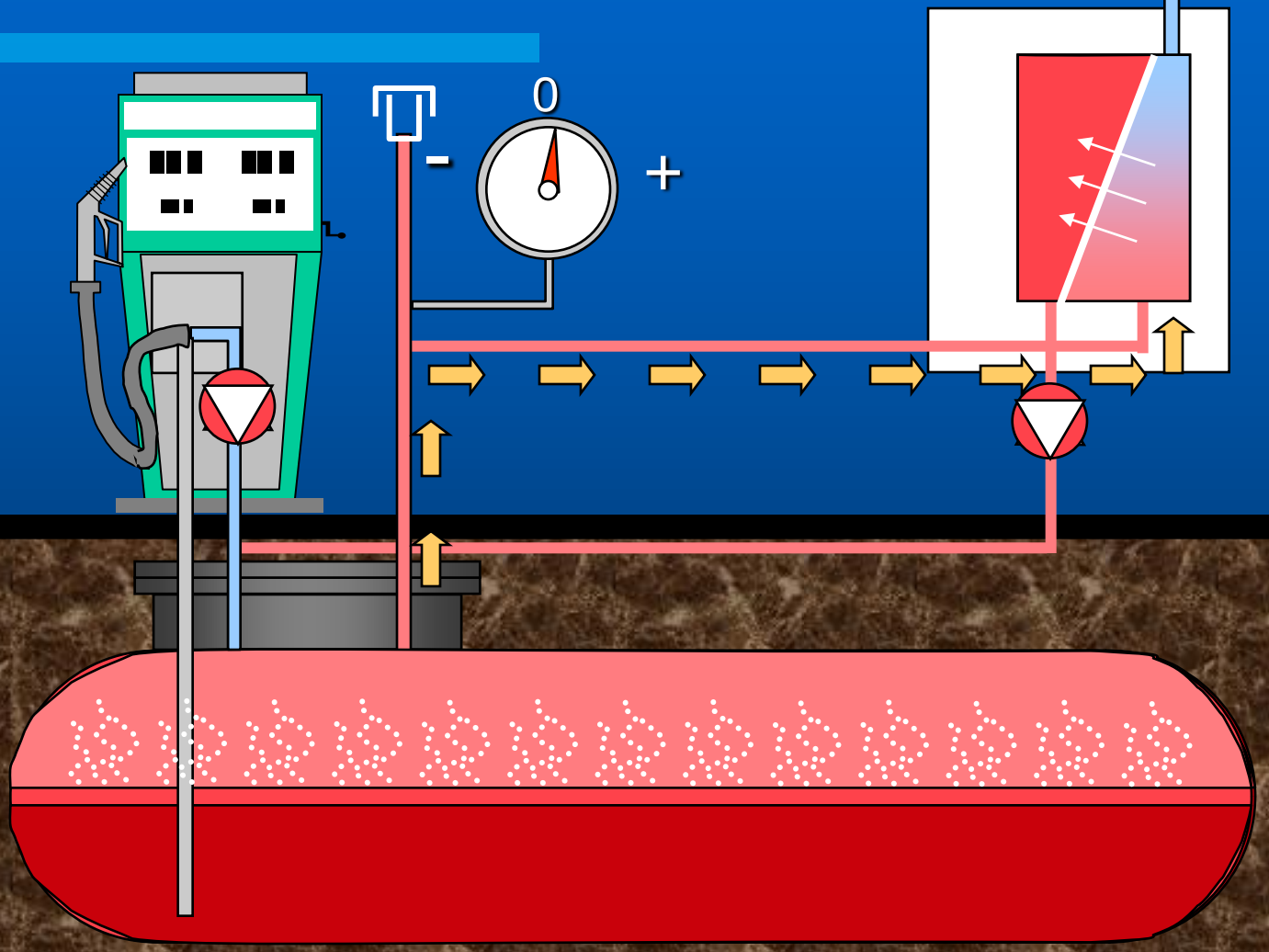
Permeator™ Systems



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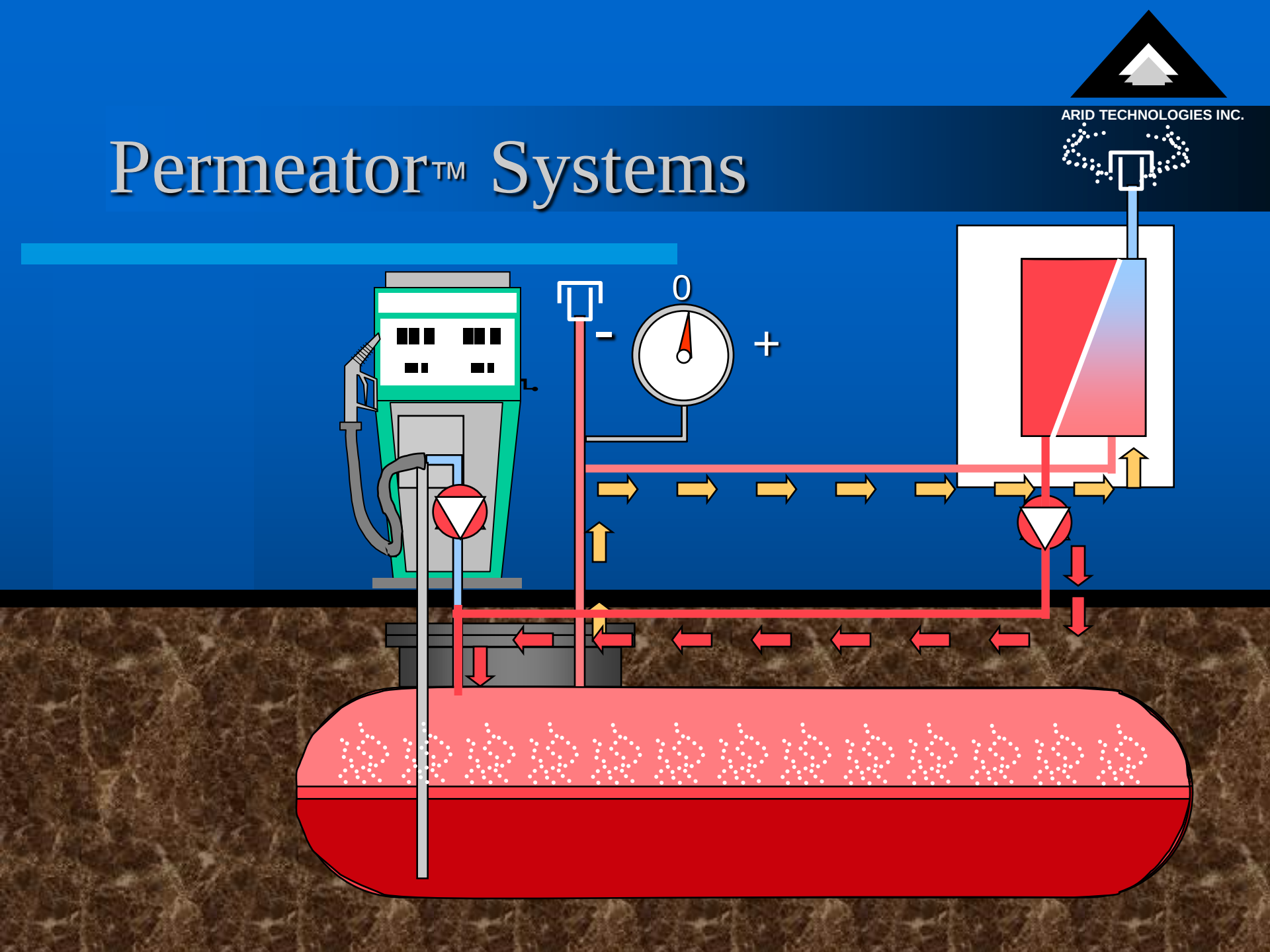

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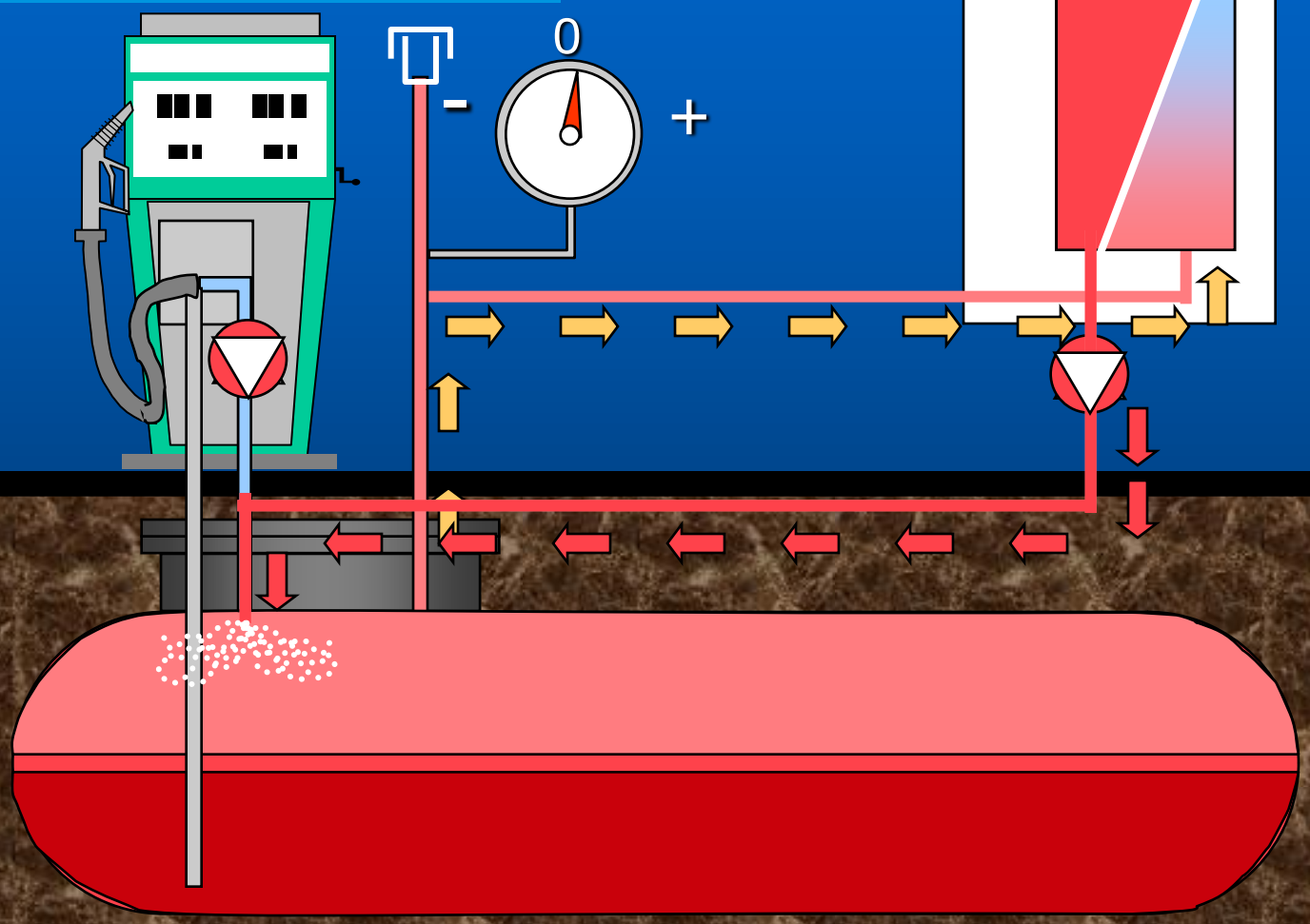
Permeator™ Systems



Permeator™ Systems

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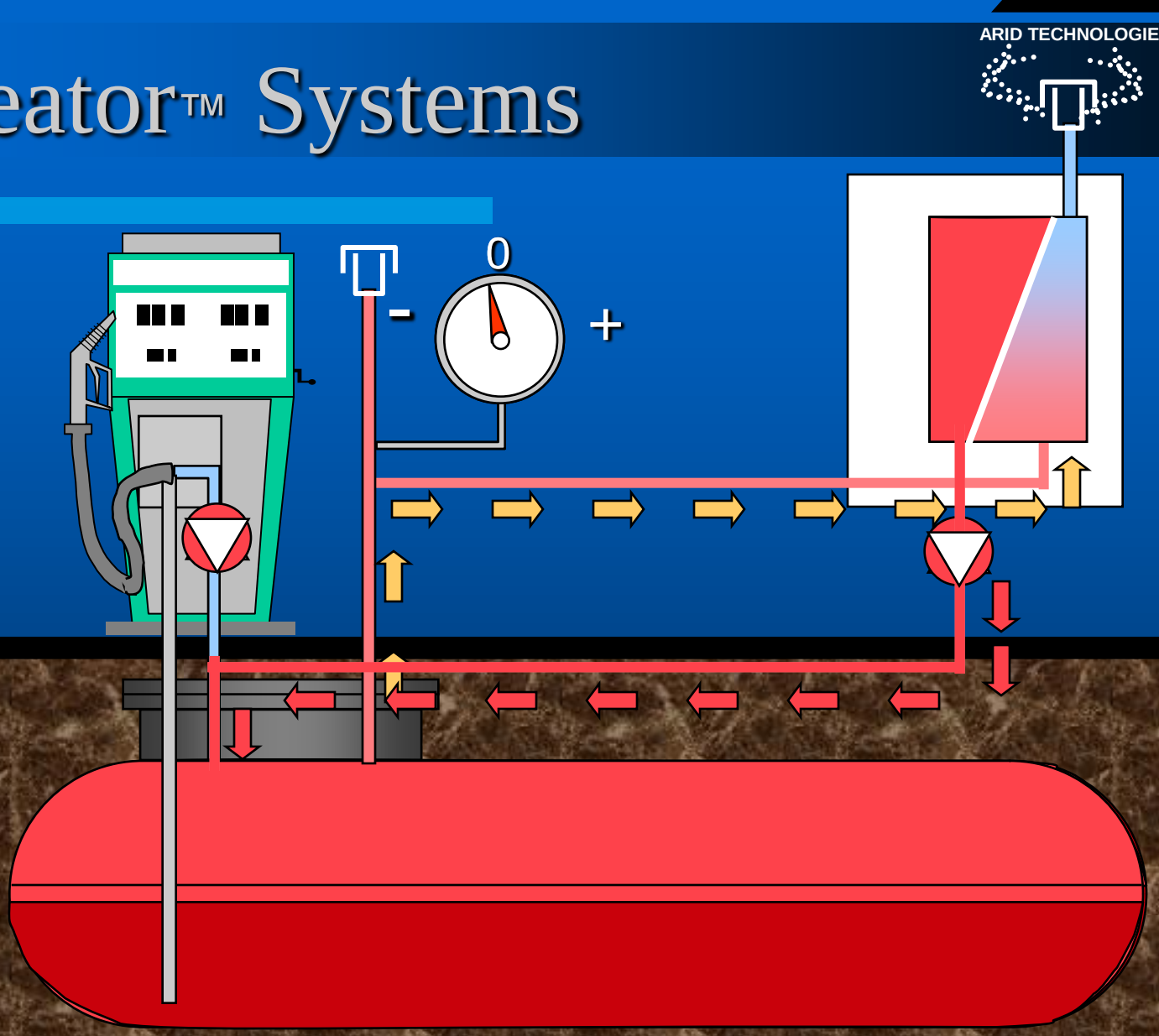
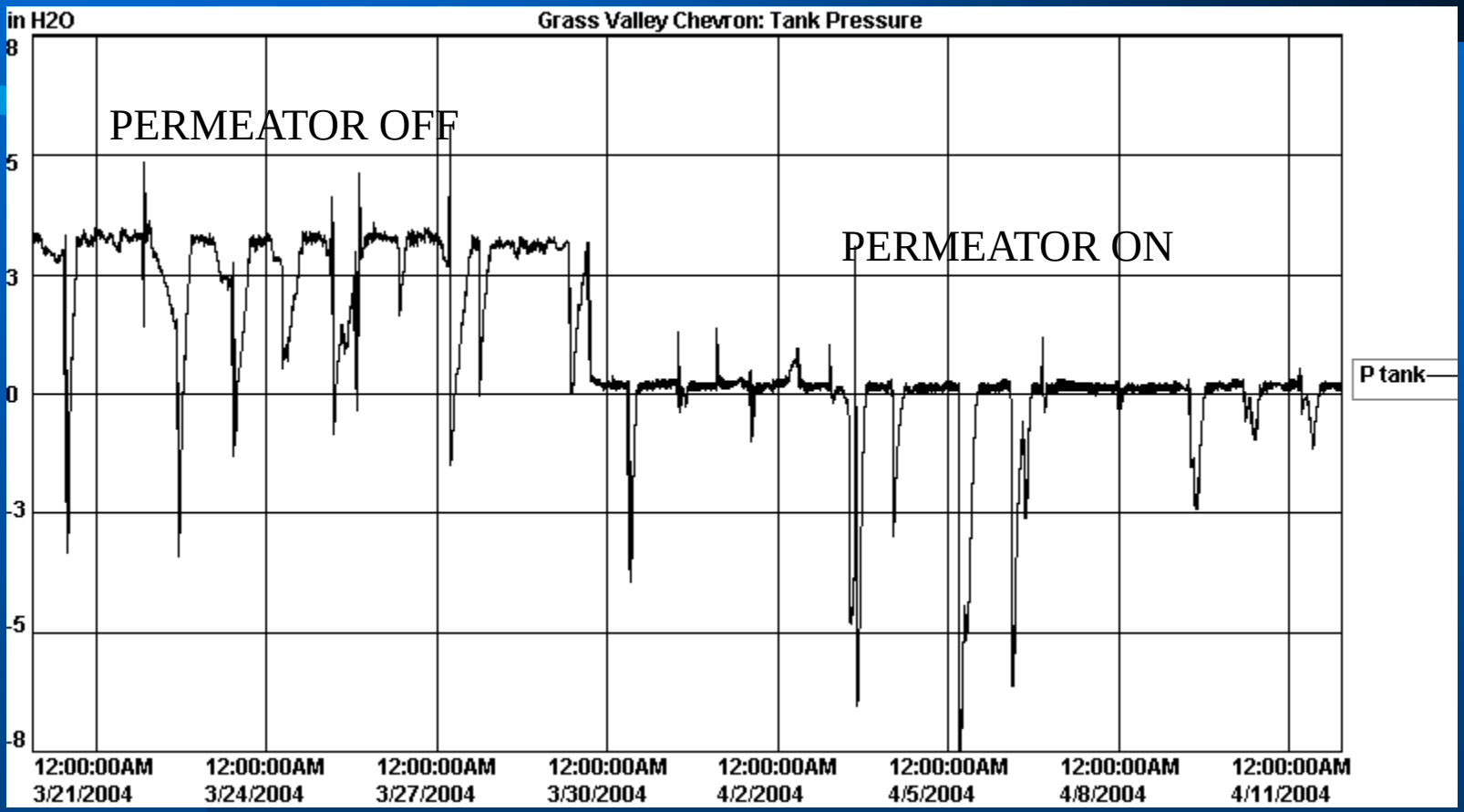
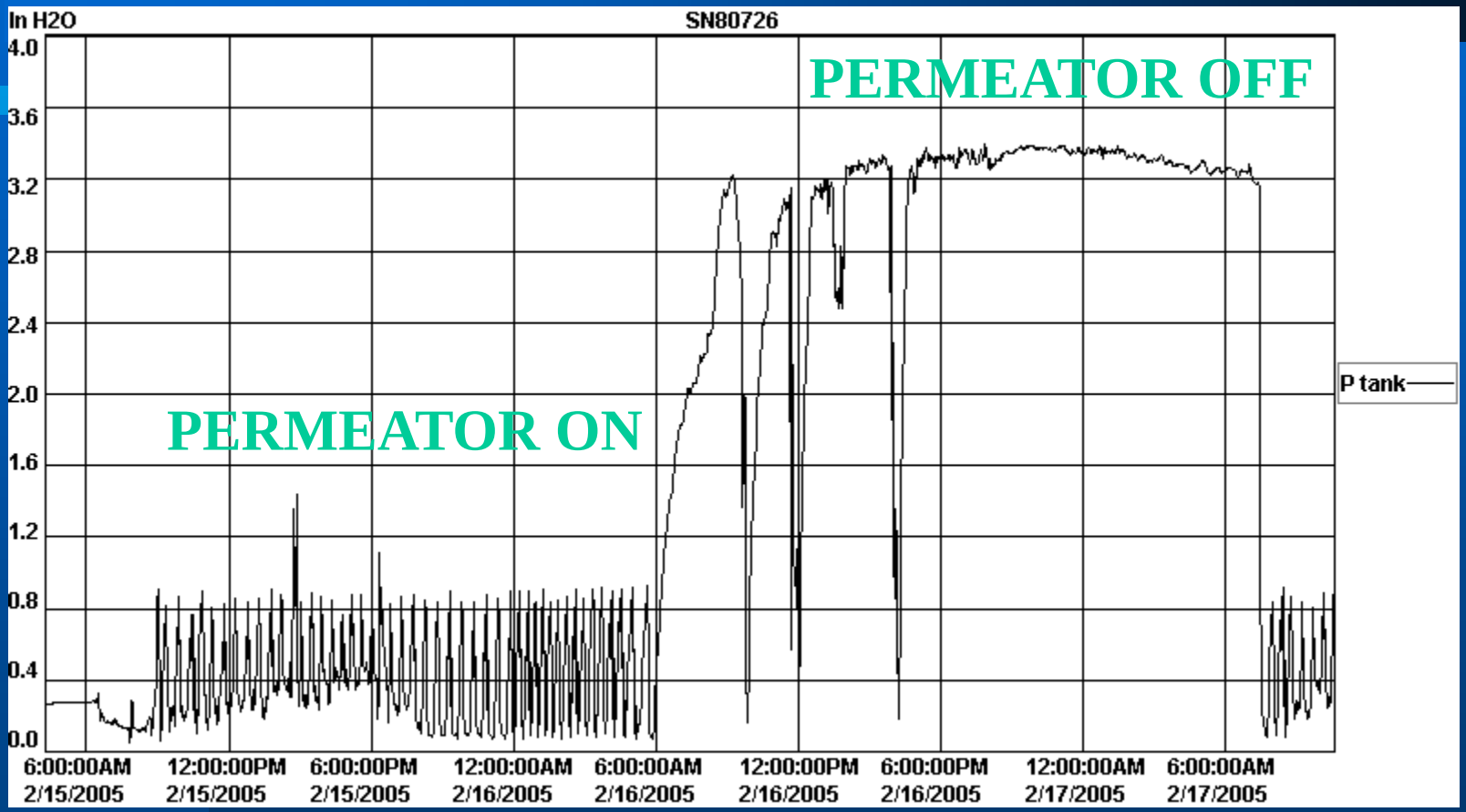
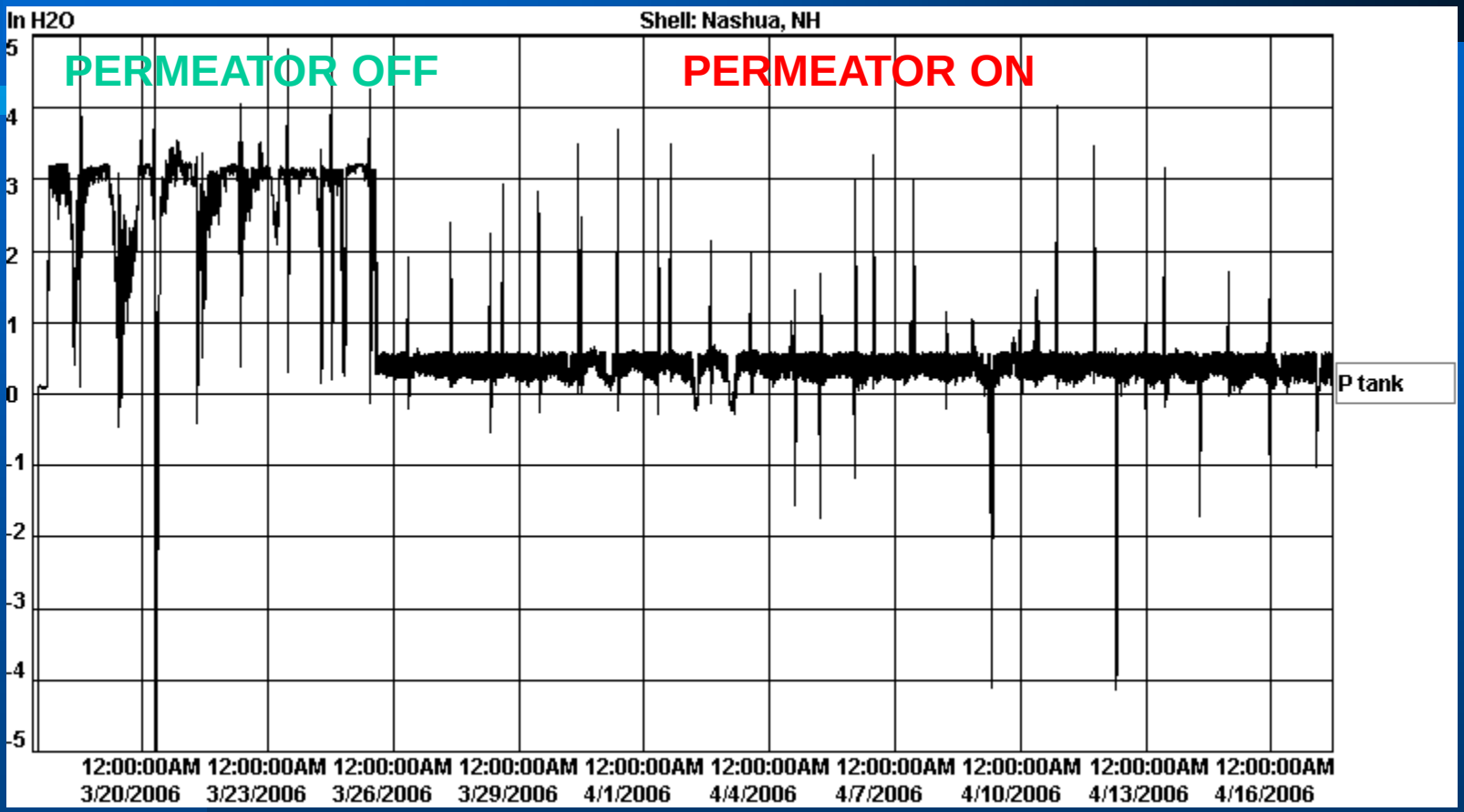



in H2O
Grass Valley Chevron: Tank Pressure
8
5
3
0
-3
-5
-8
PERMEATOR OFF
PERMEATOR ON
P tank
12:00:00AM 3/21/2004
12:00:00AM 3/24/2004
12:00:00AM 3/27/2004
12:00:00AM 3/30/2004
12:00:00AM 4/2/2004
12:00:00AM 4/5/2004
12:00:00AM 4/8/2004
12:00:00AM 4/11/2004

Lantana, Florida Test Site




In H2O
Shell: Nashua, NH
PERMEATOR OFF
PERMEATOR ON
5
4
3
2
1
0
-1
-2
-3
-4
-5
P tank
12:00:00AM 3/20/2006
12:00:00AM 3/23/2006
12:00:00AM 3/26/2006
12:00:00AM 3/29/2006
12:00:00AM 4/1/2006
12:00:00AM 4/4/2006
12:00:00AM 4/7/2006
12:00:00AM 4/10/2006
12:00:00AM 4/13/2006
12:00:00AM 4/16/2006

WAWA, Glen Mills, PA

ARID TECHNOLOGIES INC.

WAWA, Claymont, DE

ARID TECHNOLOGIES INC.

WAWA, Edgewater, MD

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Emissions at GDF

- **Total Emissions** at a GDF = Refueling Emissions + Vent Emissions + Fugitive Emissions
- *Refueling* emissions occur at the vehicle/nozzle interface
- *Vent* Emissions occur through the p/v valve
- *Fugitive* emissions occur throughout the vapor containing space and are a function of storage tank pressure

Stage II and ORVR

- The emissions from a non-ORVR vehicle are equal to 20 times the emissions from an ORVR vehicle (assuming ORVR efficiency of 95%)
- Expanding our spreadsheet analysis out to 100% ORVR, the ORVR-only case is **never more efficient** than the combination of Stage II, ORVR and an active vapor processor
- Even at 100% ORVR penetration, the state of the art solution with an active processor shows a 47% reduction in emissions; the lines never intersect.

Sample Calculation: Refueling Emissions with ORVR

ORVR Emissions = 1,260 lbm/mo. x (.72) x (1 - .95) + 1,260 lbm/mo. x (1 - .72) = 45.36 + 352.8 = 398.16 lbm/mo. x 12 months/year = 4,777.92 lbm/year (This entry is found in column 2, for year 2013 in Table 1); (8.4 lbm/1,000 gal)

Please note that this figure is derived from the ORVR penetration x (1 - the ORVR efficiency): 45.36 lbm/mo. and then one has to also ***add the raw emissions*** (on the right side of the equation; 352.8 lbm/mo.) ***from non-ORVR vehicles*** to yield the sum of 398.16 lbm/mo.

Please note that the raw emissions exceed the controlled emissions by a factor of 352.8/45.36, or 7.8 times.

Table 1: Refueling Emissions: Single GDF
USEPA ORVR Penetration Rates
Time Frame: 2011 - 2020

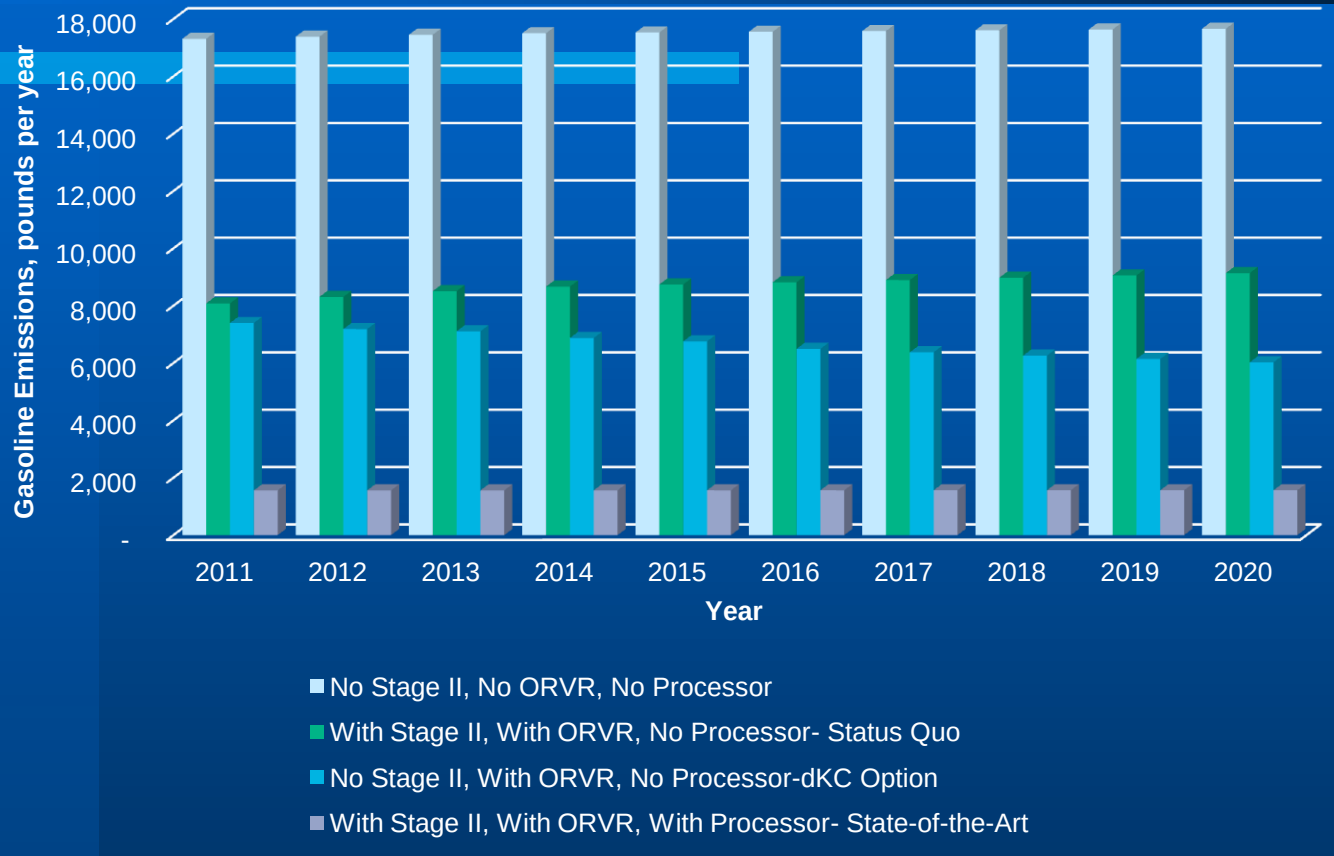
ARID TECHNOLOGIES INC.

			1	2	3
Year	ORVR Penetration Rate	Gasoline Throughput	Refueling Emissions	Refueling Emissions	Refueling Emissions
		gal/month	No Stage II/ No ORVR	No Stage II/ With ORVR	With Stage II/ With ORVR
			lbm/year	lbm/year	lbm/year
2011	69%	150,000	15,120	5,208	1,512
2012	71%	150,000	15,120	4,921	1,512
2013	72%	150,000	15,120	4,777	1,512
2014	74%	150,000	15,120	4,490	1,512
2015	75%	150,000	15,120	4,347	1,512
2016	77%	150,000	15,120	4,059	1,512
2017	78%	150,000	15,120	3,916	1,512
2018	79%	150,000	15,120	3,772	1,512
2019	80%	150,000	15,120	3,628	1,512
2020	81%	150,000	15,120	3,485	1,512

Table 2: Vent, Fugitive & Total Emissions (including IEE Emissions)

4	5	6	7	8	9	10
Storage Tank Vent & Fugitive Emissions	Storage Tank Vent & Fugitive Emissions	Storage Tank Vent & Fugitive Emissions	Total Emissions (Refueling + Storage Tank)	Total Emissions (Refueling + Storage)	Total Emissions	Total Emissions
With Stage II/ with ORVR No Processor	No Stage II/ with or without ORVR No Processor	With Processor	No Stage II, No ORVR, No Processor	No Stage II, With ORVR, No Processor	Stage II & ORVR, no Processor	Stage II, ORVR with Processor
lbm/year	lbm/year	lbm/year	lbm/year	lbm/year	lbm/year	lbm/year
6,570	2,190	45.99	17,310	7,399	8,082	1,557
6,796	2,265	47.57	17,385	7,187	8,307	1,559
6,997	2,332	48.98	17,452	7,110	8,509	1,560
7,156	2,385	50.09	17,505	6,876	8,668	1,562
7,231	2,410	50.62	17,530	6,757	8,742	1,562
7,307	2,436	51.15	17,556	6,495	8,819	1,563
7,385	2,462	51.69	17,582	6,378	8,896	1,563
7,464	2,488	52.25	17,608	6,260	8,975	1,564
7,545	2,515	52.81	17,635	6,144	9,056	1,564
7,627	2,542	53.39	17,662	6,028	9,139	1,565

Gasoline Emissions Under Various Scenarios
150,000 gallon per month refueling site



EPA ORVR Penetration & Conservative IEE

Table 3: Emissions Summary: Single GDF, 10 year time horizon 2011 - 2020

	Uncontrolled	Status Quo	Klausmeier	State-of-the-Art
	lbm	lbm	lbm	lbm
	175,226	87,198	66,634	15,625
% Reduction vs. Uncontrolled	0	50.2%	62.0%	91.1%
% Reduction vs. Klausmeier				76.6%

Table 4A: Refueling Emissions: State of CT

ARID TECHNOLOGIES INC.

			1	2	3
Year	ORVR Penetration Rate	Gasoline Throughput	Refueling Emissions	Refueling Emissions	Refueling Emissions
		gal/year	No Stage II/ No ORVR	No Stage II/ With ORVR	With Stage II/ With ORVR
			tons/year	tons/year	tons/year
2011	69%	1,244,621,566	5,227	1,800	522
2012	71%	1,244,621,566	5,227	1,701	522
2013	72%	1,244,621,566	5,227	1,651	522
2014	74%	1,244,621,566	5,227	1,552	522
2015	75%	1,244,621,566	5,227	1,502	522
2016	77%	1,244,621,566	5,227	1,403	522
2017	78%	1,244,621,566	5,227	1,353	522
2018	79%	1,244,621,566	5,227	1,304	522
2019	80%	1,244,621,566	5,227	1,254	522
2020	81%	1,244,621,566	5,227	1,204	522

Table 4B: Vent, Fugitive & Total Emissions (includes IEE Emissions)
Connecticut - Statewide

ARID TECHNOLOGIES INC.

4	5	6	7	8 (Klausmeier)	9 (Status Quo)	10 (State of the Art)
Storage Tank Vent & Fugitive Emissions	Storage Tank Vent & Fugitive Emissions	Storage Tank Vent & Fugitive Emissions	Total Emissions (Refueling + Storage Tank)	Total Emissions (Refueling + Storage)	Total Emissions	Total Emissions
With Stage II/ with ORVR No Processor	No Stage II/ with or without ORVR No Processor	With Processor	No Stage II, No ORVR, No Processor	No Stage II, With ORVR, No Processor	Stage II & ORVR, no Processor	Stage II, ORVR with Processor
tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
6,129	2,043	42.91	7,271	3,844	6,652	565
6,191	2,064	43.34	7,291	3,766	6,714	566
6,256	2,086	43.80	7,313	3,737	6,779	566
6,320	2,107	44.25	7,334	3,659	6,843	566
6,386	2,129	44.70	7,356	3,632	6,908	567
6,452	2,151	45.17	7,378	3,554	6,975	567
6,520	2,173	45.64	7,401	3,527	7,043	568
6,589	2,197	46.13	7,424	3,501	7,112	568
6,660	2,220	46.62	7,448	3,475	7,183	569
6,732	2,244	47.13	7,472	3,449	7,255	569

Table 4C: State of the Art vs. Klausmeier & Status Quo
Connecticut - Statewide

ARID TECHNOLOGIES INC.

State of CT Savings	Emissions Reductions	Fuel Savings	Fuel Savings	State of CT Savings	Emissions Reductions	Fuel Savings	Fuel Savings
State of the Art vs. Klausmeier				State of the Art vs. Status Quo			
tons/year	%	gal/year	$/yr. @ $3.50/gal	tons/yr.	%	gal/yr.	$/yr.
3,278	85%	1,311,379	4,589,826	6,087	91%	2,434,741	8,521,594
3,199	85%	1,279,774	4,479,208	6,149	92%	2,459,459	8,608,108
3,171	85%	1,268,367	4,439,283	6,213	92%	2,485,193	8,698,175
3,092	85%	1,236,989	4,329,461	6,277	92%	2,510,603	8,787,110
3,064	84%	1,225,642	4,289,748	6,341	92%	2,536,521	8,877,823
2,987	84%	1,194,602	4,181,106	6,407	92%	2,562,957	8,970,350
2,959	84%	1,183,599	4,142,597	6,475	92%	2,589,922	9,064,728
2,932	84%	1,172,774	4,104,709	6,544	92%	2,617,427	9,160,993
2,905	84%	1,162,129	4,067,453	6,614	92%	2,645,481	9,259,184
2,879	83%	1,151,669	4,030,843	6,685	92%	2,674,097	9,359,339
			Total $ 42,654,234				Total $ 89,307,403

Table 4D: Revenue per Ton of Emissions Reduced

CT Sites for Processor	Cost per CT Site, Installed	Average Fuel Savings, Statewide	Average Emissions Reductions, Statewide	Emissions Reductions Cost or Revenue
Number	$	10 year period; $/yr. @ $3.50/gal	10 year period; tons/year	Revenue, $/ton reduced
1,060	40,000	8,930,740	6,379	1,400

Table 4E: Revenue per Ton of Emissions Reduced 2011- 2020

Total Cost for Processors	Financing Cost	Net Cost (Net Revenue)	Net Revenue for Emissions Reductions
$	10 yr., straight line		
	$/yr.	$/yr.	$/ton
42,400,000	4,240,000	+ 4,690,740	+ 735

GDF Benefit Summary

- *Enhancement of Stage I; pressure spikes during bulk tanker deliveries are processed by Permeator*
- *Enhancement of Stage II; providing ORVR/Stage II Compatibility, without the use of any special nozzles or other special hardware on the "front-end" Stage II system (i.e. Conventional Stage II can remain in place)*
- *On-going and continuous pressure monitoring; we measure tank pressure every 4 seconds and store a 2 minute average; we also monitor and store ambient temperature and atmospheric pressure; where any critical variables (such as tank pressure) which fall outside of a prescribed range trigger an automatic e-mail alert sent to our central monitoring center*
- *Economical payback on invested capital; where the fuel savings rate averages 2 gallons of fuel saved per 1,000 gallons of fuel dispensed*
    - *For smaller throughput sites, the Permeator system is available under a shared savings arrangement; whereby the unit is provided for zero cost, and the GDF owner/operator makes monthly payments to ARID equal to 50% of the fuel savings*
- The aggregate benefits for the State of Connecticut GDF operators include $8.9 million per year in fuel savings while at the same time reducing emissions of volatile organic compounds and air toxics by 6,379 tons per year.

Economics at Typical GDF
150,000 gallons/month

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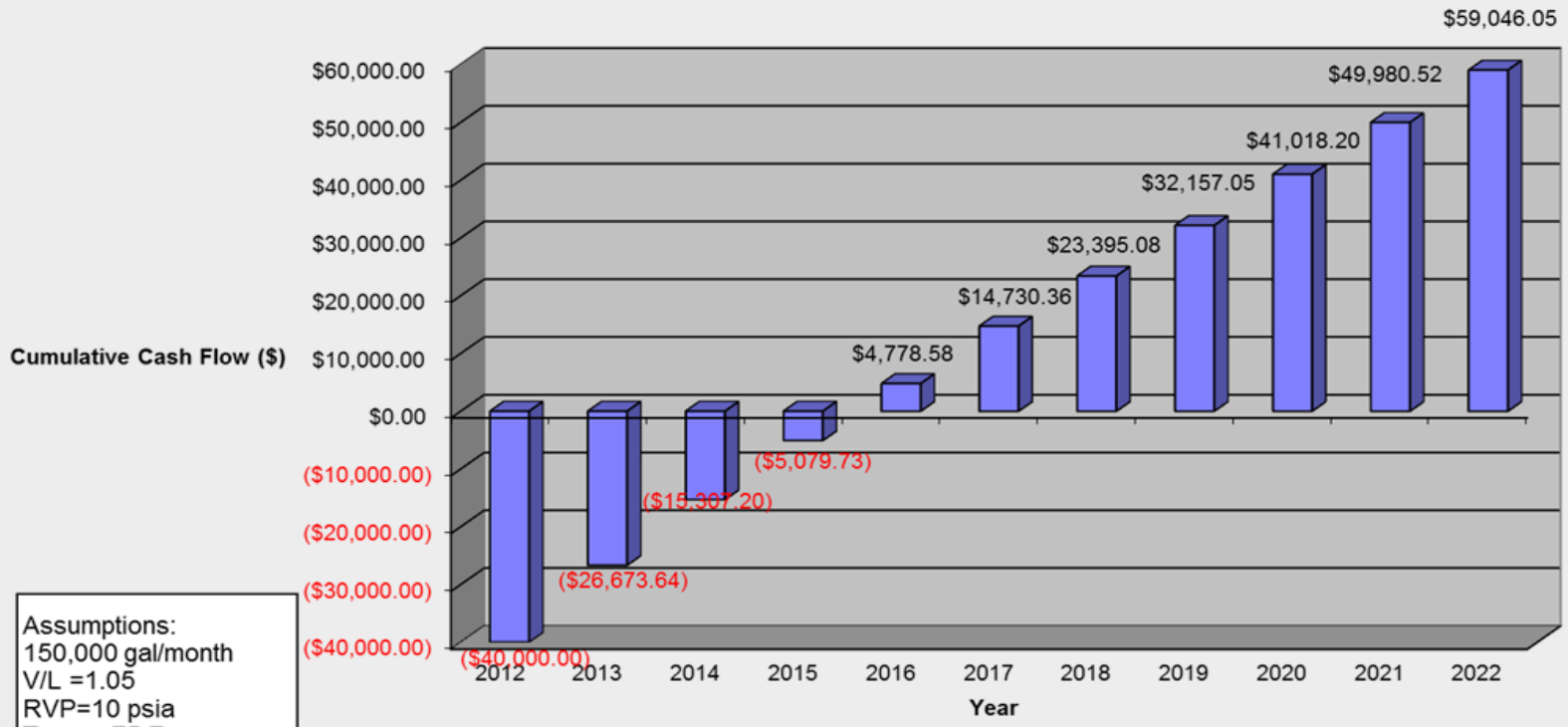
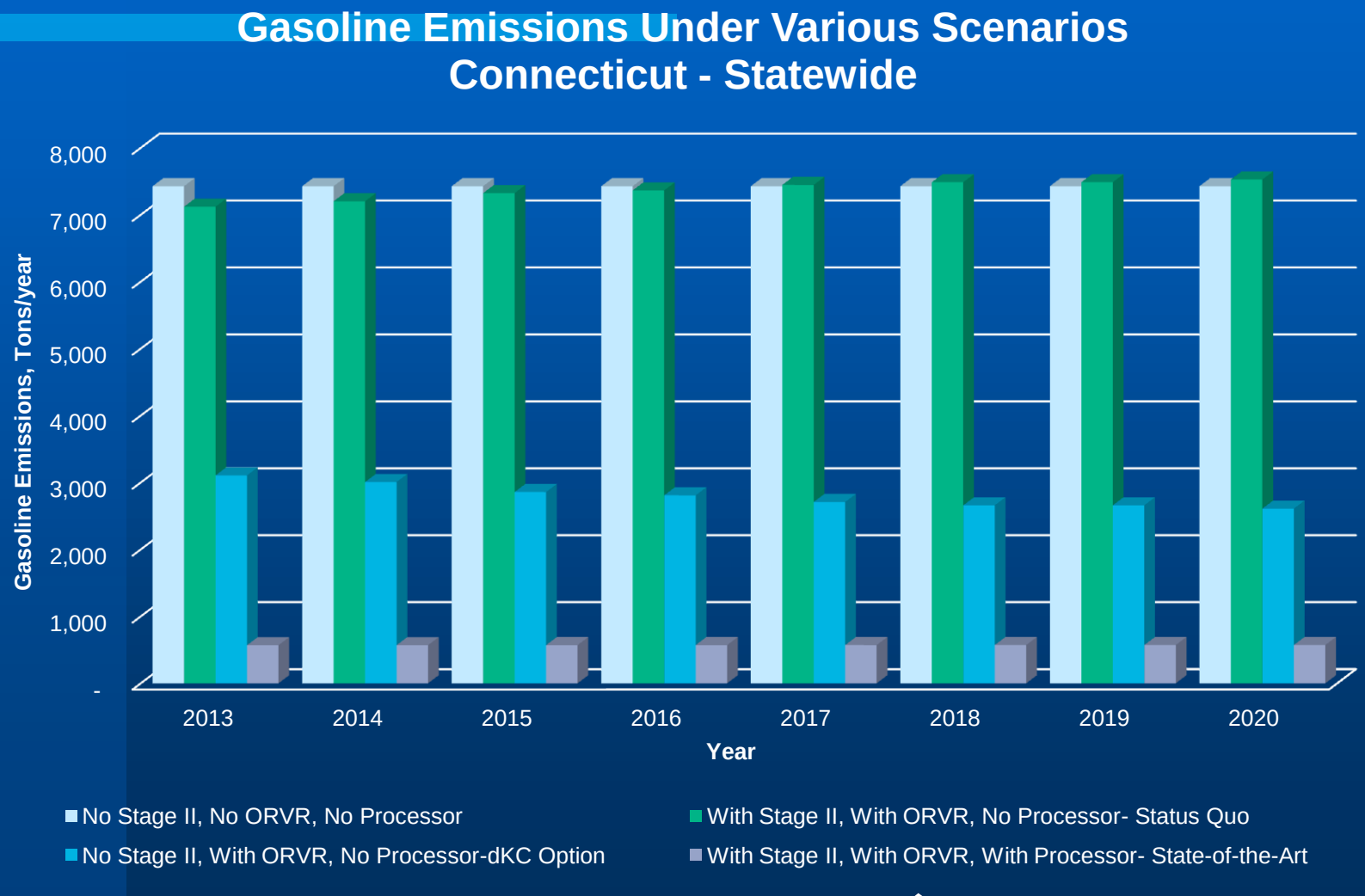


Assumptions:
150,000 gal/month
V/L =1.05
RVP=10 psia
Temp= 75 F
Altitude = 750 ft
Fuel Value = $3.50/gal

87% ORVR: Year 2013
IEE From ARID ELM



87% ORVR, IEE From ARID ELM

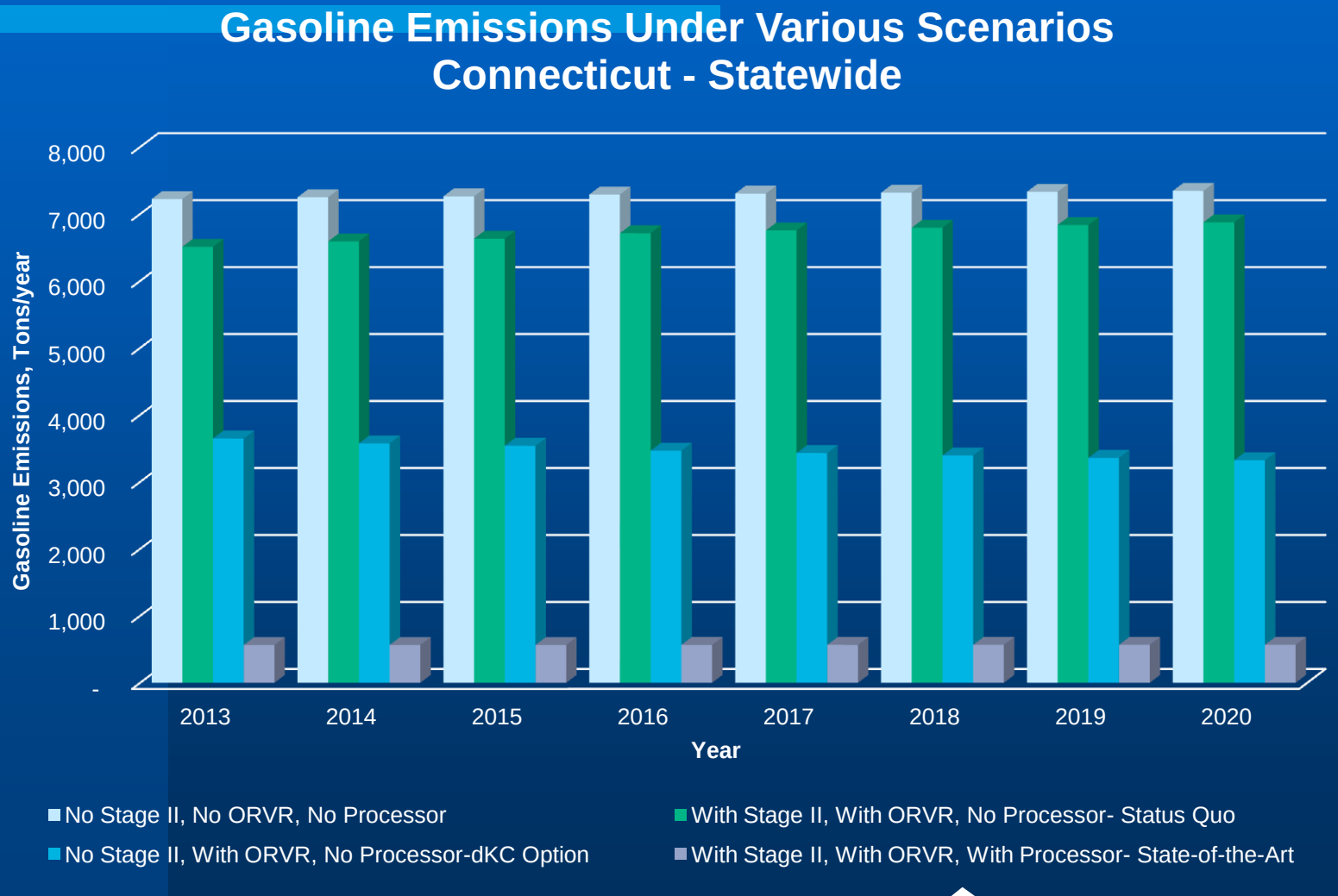
	Uncontrolled	Status Quo	Klausmeier	State-of-the-Art
	tons/year	tons/year	tons/year	tons/year
	59,412	58,953	22,415	4,565
% Reduction vs Uncontrolled	0	0.8%	62.3%	92.3%
% Reduction vs Klausmeier				79.6%

CT Sites for Processor	Cost per CT Site, Installed	Average Fuel Savings, Statewide	Average Emissions Reductions, Statewide	Emissions Reductions Cost or Revenue
Number	$	10 year period; $/yr @ $3.50/gal	10 year period; tons/year	Revenue, $/ton reduced
1,060	40,000	9,517,903	6,799	1,400

87% ORVR, IEE From ARID ELM

Total Cost for Processors	**Financing Cost**	**Net Cost**	**Net Revenue for Emissions Reductions**
$	10 yr, straight line		
	$/yr	$/yr	$/ton
42,400,000	4,240,000	5,277,903	776

72% ORVR: Year 2013: IEE FROM ARID ELM 2013 - 2020



72% ORVR, IEE From ARID ELM

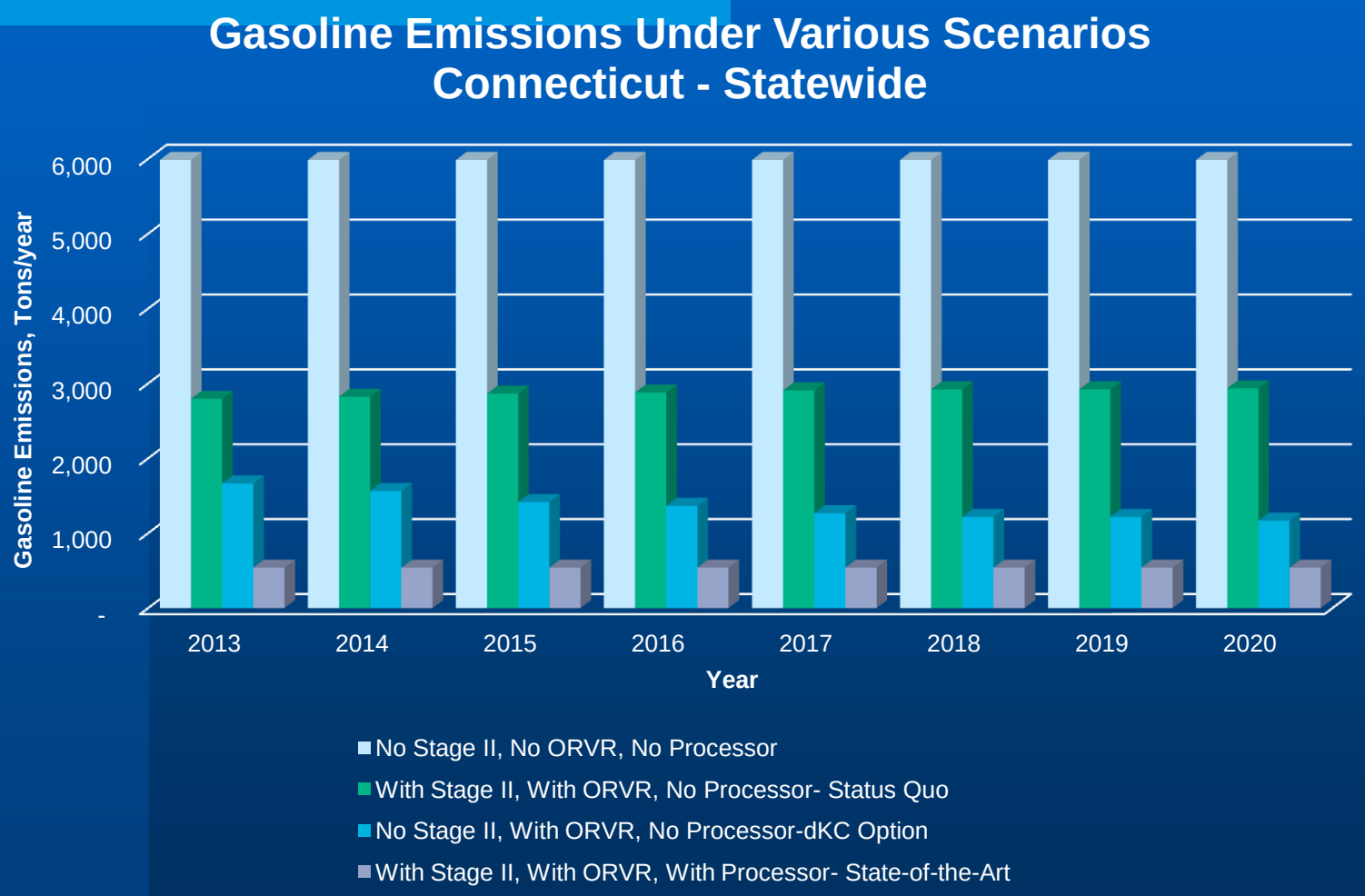
	Uncontrolled	Status Quo	Klausmeier	State-of-the-Art
	tons/year	tons/year	tons/year	tons/year
	58,327	53,706	27,736	4,529
% Reduction vs Uncontrolled	0	7.9%	52.4%	92.2%
% Reduction vs Klausmeier				83.7%

CT Sites for Processor	Cost per CT Site, Installed	Average Fuel Savings, Statewide	Average Emissions Reductions, Statewide	Emissions Reductions Cost or Revenue
Number	$	10 year period; $/yr @ $3.50/gal	10 year period; tons/year	Revenue, $/ton reduced
1,060	40,000	8,605,995	6,147	1,400

72% ORVR; IEE from ARID ELM

Total Cost for Processors	Financing Cost	Net Cost	Net Revenue for Emissions Reductions
$	10 yr, straight line		
	$/yr	$/yr	$/ton
42,400,000	4,240,000	4,365,995	710

87% ORVR Year 2013:
Conservative IEE of 3.65 lbm/1,000 gal: Year 2013



87% ORVR, Conservative IEE

	Uncontrolled	Status Quo	Klausmeier	State-of-the-Art
	tons/year	tons/year	tons/year	tons/year
	47,876	23,040	10,879	4,314
% Reduction vs Uncontrolled	0	51.9%	77.3%	91.0%
% Reduction vs Klausmeier				60.3%

CT Sites for Processor	Cost per CT Site, Installed	Average Fuel Savings, Statewide	Average Emissions Reductions, Statewide	Emissions Reductions Cost or Revenue
Number	$	10 year period; $/yr @ $3.50/gal	10 year period; tons/year	Revenue, $/ton reduced
1,060	40,000	3,277,008	2,341	1,400

87% ORVR, Conservative IEE Worst Case Savings Scenario

Total Cost for Processors	Financing Cost	Net Cost	Net Revenue for Emissions Reductions
$	10 yr, straight line		
	$/yr	$/yr	$/ton
42,400,000	4,240,000	(962,992)	-411

Summary

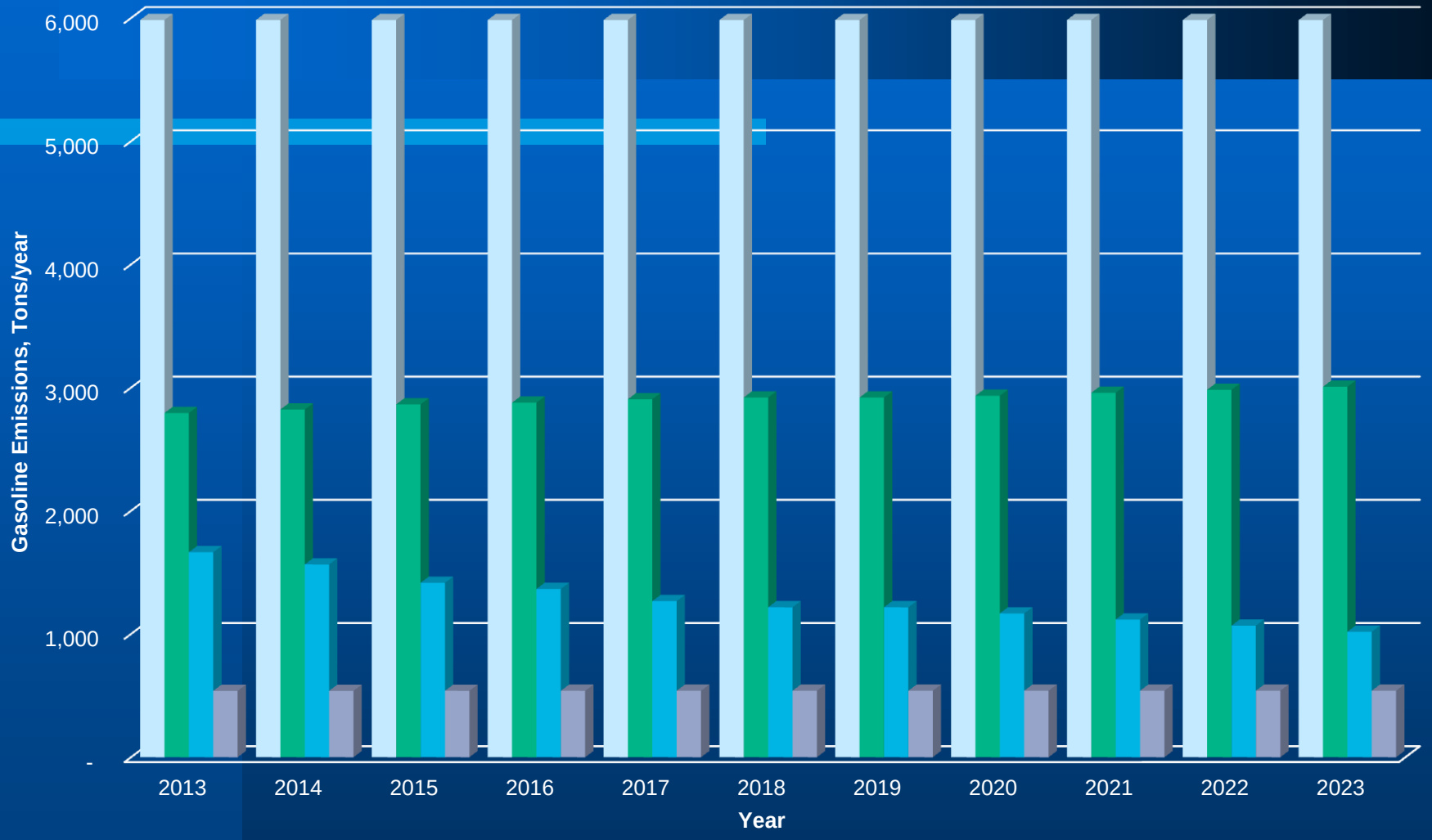
ARID TECHNOLOGIES INC.

	Net Revenue for Emissions Reductions	**Net Revenue for Emissions Reductions**
		(with annual Stage II Op exp @ $3,277 per site)
	$/ton	**$/ton**
72% ORVR Year 2013 USEPA	$710	$145
IEE from ARID ELM		
87% ORVR Year 2013: Klausmeier	$776	$265
IEE from ARID ELM		
87% ORVR Year 2013: Klausmeier	($411)	($1,895)
Conservative IEE of 3.65 lbm/1,000 gal		

Typically,($10,000) / ton is considered a viable project

Gasoline Emissions : 87% ORVR, Conservative IEE
Connecticut - Statewide: 100% ORVR in 2023

ARID TECHNOLOGIES INC.



ARID TECHNOLOGIES INC.

Lantana, Florida Test

Third Party Test w/USEPA Oversight

Stage II Vac Assist Site

Feb 2005

Stage II Vapor Recovery Systems — Options Paper

U.S. EPA
Office of Air Quality Planning and Standards
Emissions Monitoring and Analysis Division
Emissions Factors and Policy Applications Group (C339-02)
February 7, 2006

(this document included with email)

Test Site Conditions

- Average overall V/L = 0.97
- ORVR Population via CARB penetration figures = 38.9%
- Gasoline RVP = 11.1 psia
- Storage Tank Temperature = 74 F
- Altitude = 25 feet above sea level

Third Party Test Results

- 1.) Measured loss of gasoline with P/V valves OFF = 21.31 gallons per day (3.48 lbm/1,000 gal)
- 2.) Measured loss of gasoline with P/V valves ON = 11.08 gallons per day
- 3.) Predicted loss with ARID's proprietary Evaporative Loss Model (ELM) = 23.12 gallons per day
- 4.) Predicted loss using ELM for year 2014 = 58.04 gallons per day

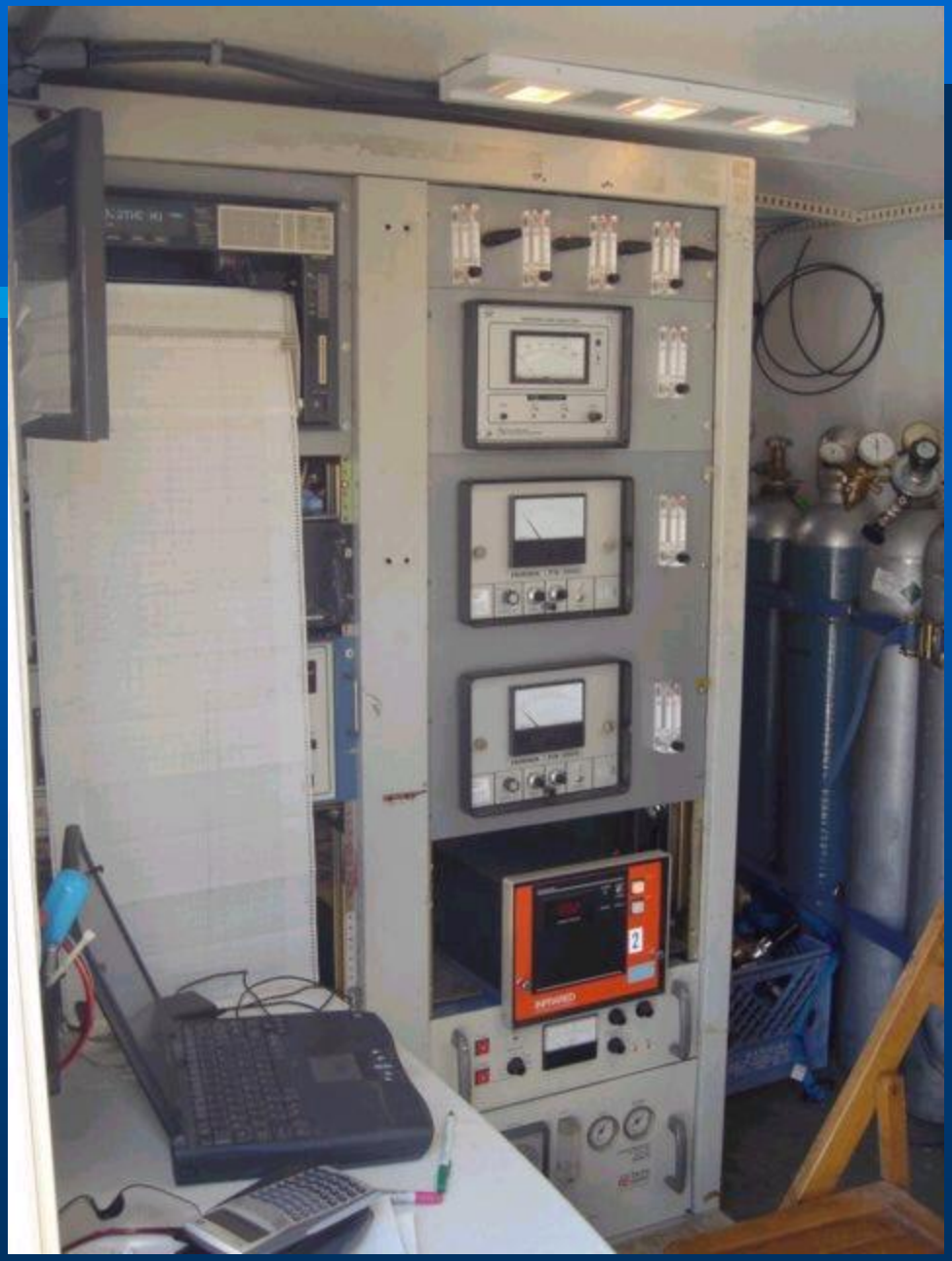
Additional Observations (cont'd.)

- Discrepancy between measured losses with the P/V valves "ON" vs. "OFF" are due to fugitive leaks
- Example; Overfill drain valve in fill bucket of premium storage tank was leaky at elevated pressure
- Components may "pass" the leak decay test at +2.0 iwc, but exhibit leaks at higher pressures which are still below the p/v valve setting of +3.0 iwc


RECEIVING


CLOSE
TIRE SALES


WELLS CARGO



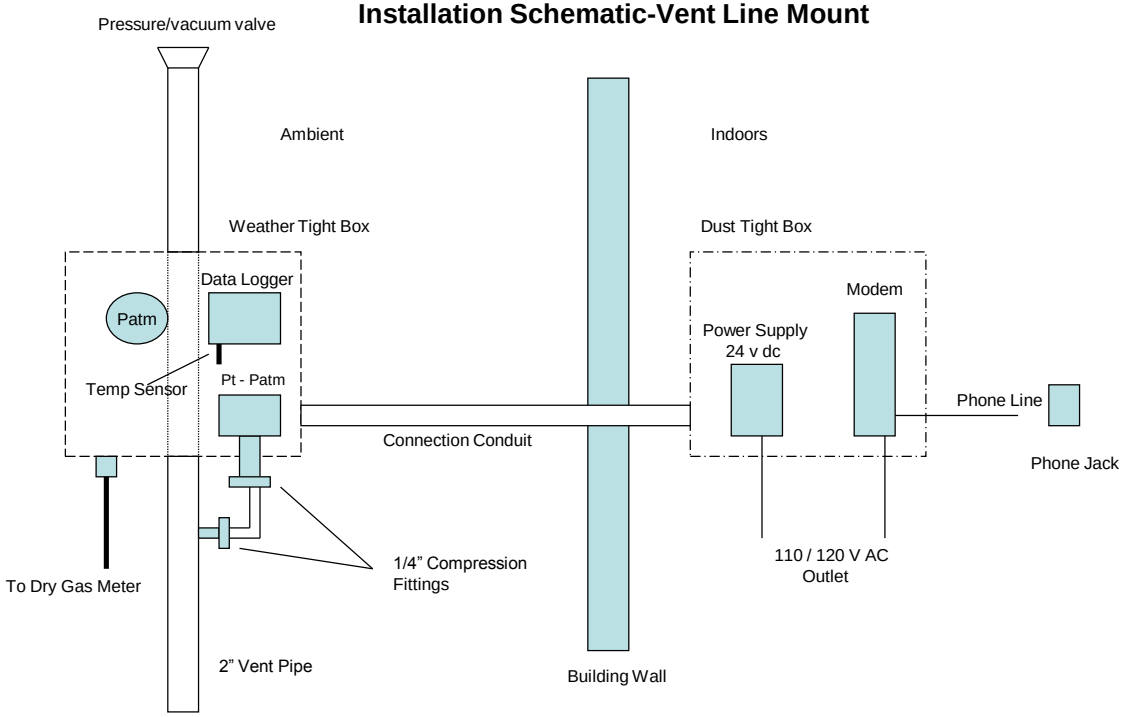
ARID TECHNOLOGIES INC.

Federal Way, Washington Test

Stage II Vac Assist Site

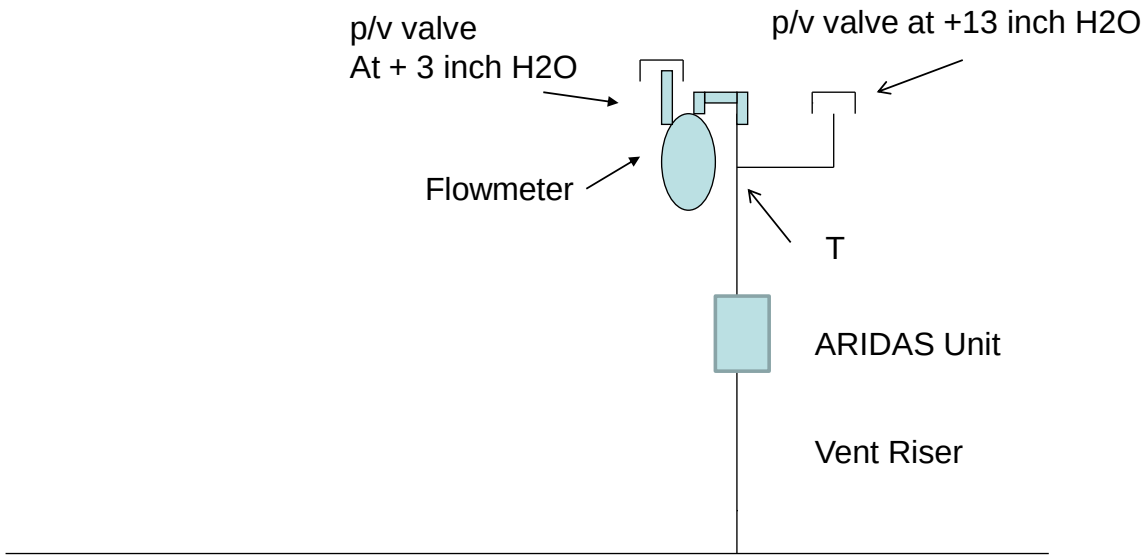
Oct – Dec 2009

ARIDAS 150


Installation Schematic-Vent Line Mount
Pressure/vacuum valve
Ambient
Indoors
Weather Tight Box
Dust Tight Box
Data Logger
Patm
Modem
Power Supply
24 v dc
Temp Sensor
Pt - Patm
Phone Line
Connection Conduit
Phone Jack
To Dry Gas Meter
1/4" Compression
Fittings
110 / 120 V AC
Outlet
2" Vent Pipe
Building Wall


ARID Technologies, Inc.

Test Equipment Schematic (with Flowmeter)



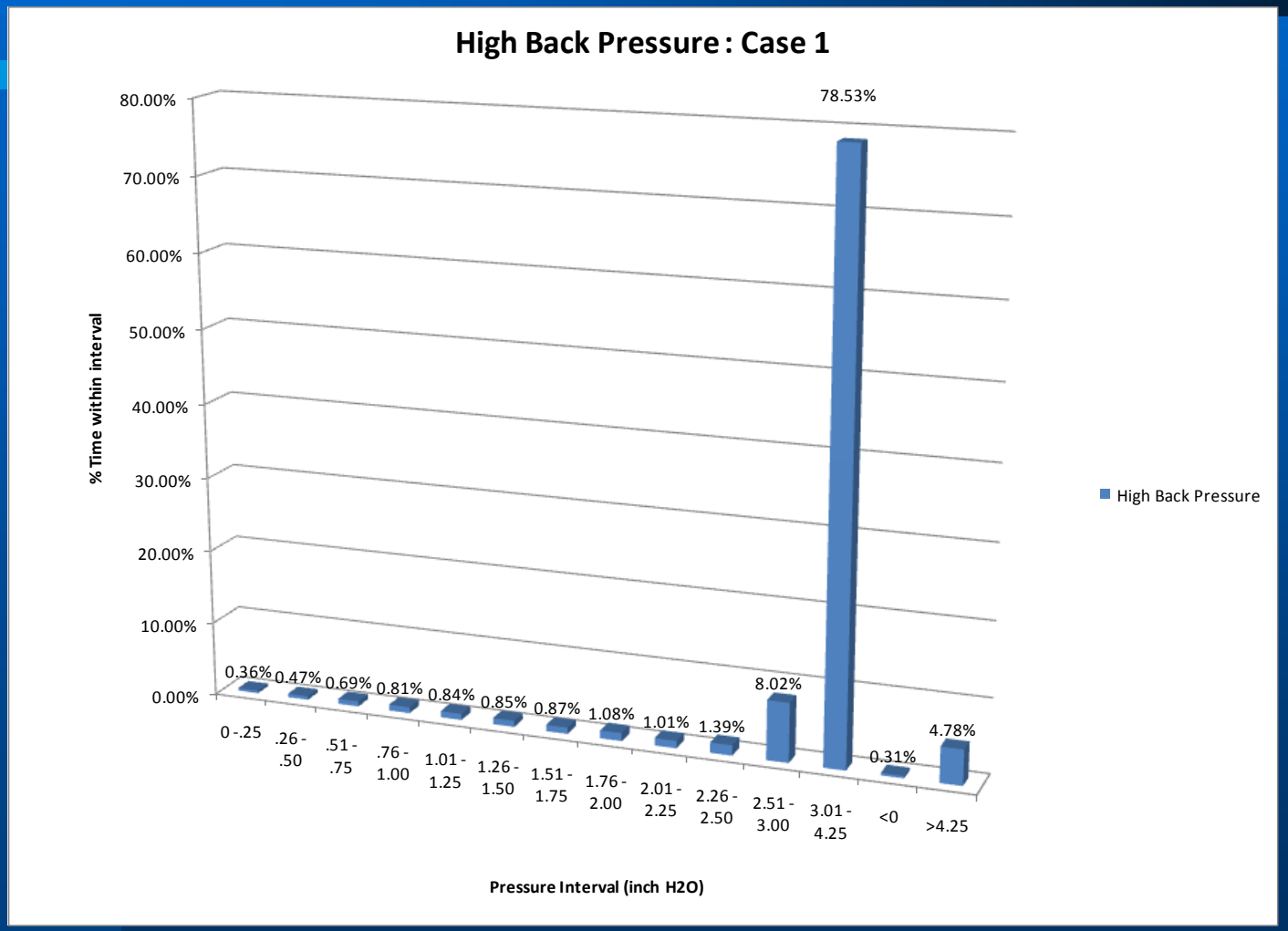
SB-3535.3

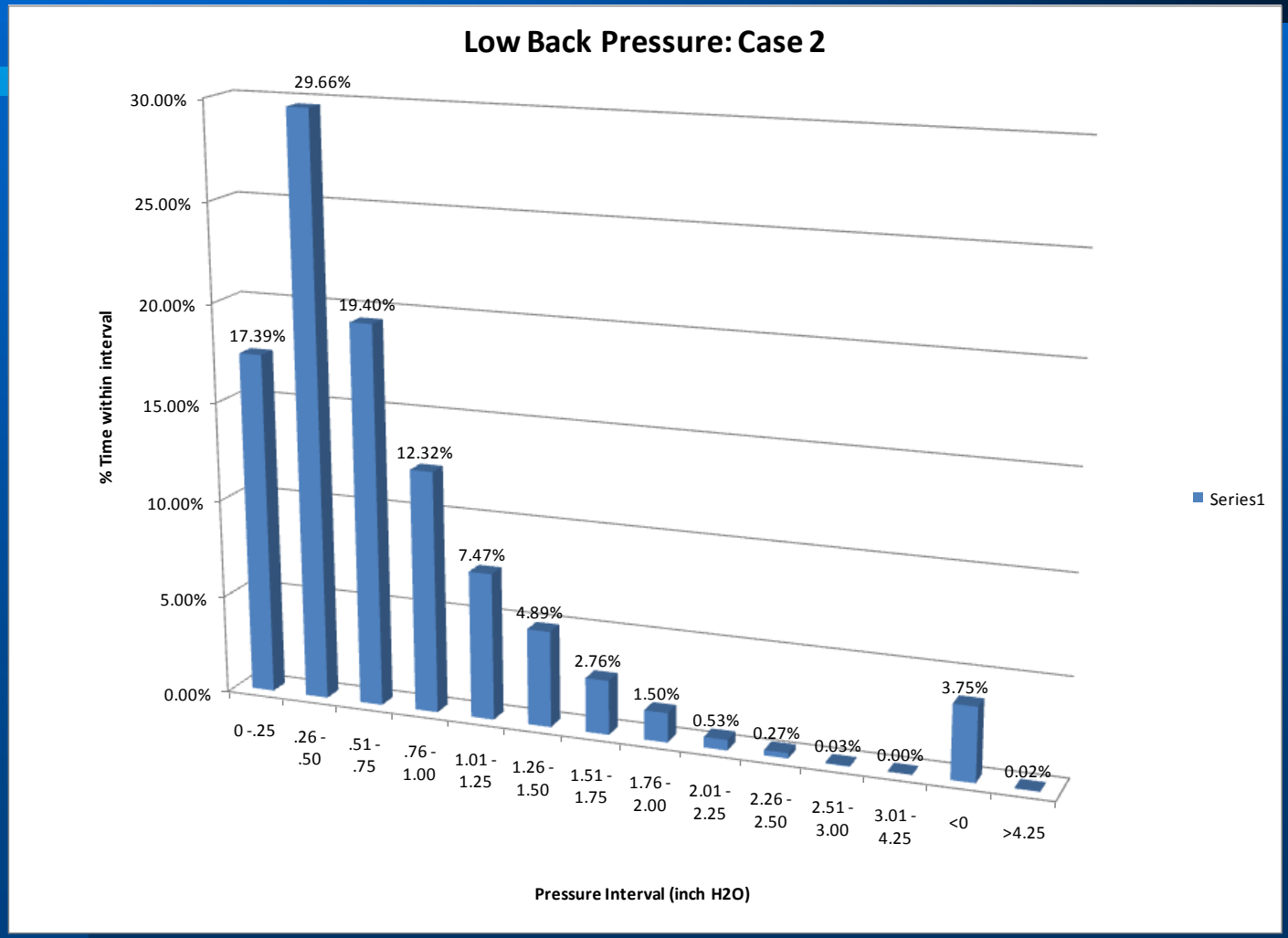
AC-250

the utility standard

AMERICAN METER COMPANY

Federal Way Test: Tank Pressure Profile




Low Back Pressure: Case 2
% Time within interval
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
29.66%
19.40%
17.39%
12.32%
7.47%
4.89%
2.76%
1.50%
0.53%
0.27%
0.03%
0.00%
3.75%
0.02%
0 -.25
.26 - .50
.51 - .75
.76 - 1.00
1.01 - 1.25
1.26 - 1.50
1.51 - 1.75
1.76 - 2.00
2.01 - 2.25
2.26 - 2.50
2.51 - 3.00
3.01 - 4.25
<0
>4.25
Pressure Interval (inch H2O)
Series1

Emissions Reductions and Savings Summary
Raw Data

	Vent Emissions	Average Tank Pressure	Fugitive Emissions	Total Emissions	Average Ambient Temp	Average Atmospheric Pressure
	(cfm)	*(inches H2O)*	*(cfm)*	*(cfm)*	*(deg F)*	*(inches H2O)*
1	0.504	3.343	0.270	0.774	50.737	403.648
2	0.698	0.592	0.111	0.809	40.137	405.405

Fuel Savings & Emissions Reduction Summary

Total Emissions	HC Conc	Gallons of Fuel	Gallons of Fuel	Gallons of Fuel	Emissions Reduced	Value of Fuel
(cfm)	*(%)*	*(per day)*	*(per month)*	*(per year)*	*(tons/year)*	*($/yr) @$2.85 gal)*
0.774	50%	19.05	590.64	7,087	**17.719**	**$20,200**
0.809	50%	19.92	617.56	7,410	**18.527**	**$21,120**

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